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Coding Sustainable Neighborhoods: A Comparative Analysis of LEED for Neighborhood Development and the Healthy Development Measurement Tool

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Coding Sustainable Neighborhoods: A Comparative Analysis of LEED for Neighborhood Development and the Healthy Development Measurement Tool

by

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Dedication

This work is dedicated to those who believe the answer to our problems cannot be found by simply optimizing the solution, but by maximizing the number of solutions available.

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Abstract

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The University of Texas at Austin, 2012

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Neighborhood design has a significant impact on environmental and human health and is largely regulated by the codes developed by various professional organizations. While the sustainability movement as a whole has embraced the mutually beneficial goals of improving environmental and human health, the work of professionals in the environmental and public health fields has remained largely segregated over the past century.

The purpose of my thesis is to compare the approach of each field in fostering sustainable neighborhoods through the development and implementation of codes and to quantify both the existing degree of collaboration and the latent potential for further collaboration within these codes. For comparison, I selected LEED for Neighborhood Development and the Healthy Development Measurement Tool to be representative of neighborhood codes generated by the environmental and public health movements,

respectively, because they are the most fully developed and widely implemented evaluation systems presently available in each field.

In order to investigate how the codes generated in each field compare in their approach, structure, and organization, I first performed a comparative analysis between them. I then performed a content analysis on both codes to quantify the overlap in goals between them. My hypothesis was that each field would exhibit a bias towards goals which explicitly support their own field, but that a significant portion of their goals would simultaneously support the other field. This hypothesis proved to be correct, but most interesting was the significant percentage of shared goals that were left unexpressed. Ultimately, 94% of recommended actions in LEED-ND were related to human health, though it was only explicitly referenced in 25% of the code. Similarly, 74% of recommended actions in the HDMT were related to environmental health, though it was only explicitly mentioned in 33% of the code. My thesis demonstrates that, while both fields already recognize that a small portion of their goals are shared, it is actually likely that nearly all of their goals are shared. By actively acknowledging these shared goals, both fields can potentially benefit from the greater amount of support, resources, and expertise that would become available to them through collaboration.

Table of Contents

List of Tables xi

List of Figures xiii

Chapter 1: Introduction 1

Chapter 2: Environmental and Public Health Movements 3

Environmental Movements 3

Ecological Modernization Movement 3

Environmental Justice Movement 5

Built Environment and Public Health Movement 7

Public Health Movements 8

Chapter 3: Methodology 13

Research Paradigm 13

Research Questions 14

Comparative Analysis 15

Code Selection 15

Code Comparison 19

Content Analysis 19

Communication Typology 20

Unit of Analysis 21

Coding Scheme 22

Intersubjectivity and A Priori Design 27

Intercoder Reliability 31

Generalizability 34

Replicability 35

Hypothesis Testing 36

Quantitative and Summarizing 36

Limitations 36

Chapter 4: Built Environment Code Elements....37
Sustainable Community Frameworks....37
Framework Scale....40
Construction Frameworks....40
Inhabitant Framework....41
Organization Framework....43
Multi-Scale Framework Integration....44
Contested Multi-Scale Framework Integration....46
Framework Type....50
Sustainable Neighborhood Codes....53
Measurement and Enforcement of Built Environment Codes....53
Economic Codes....54
Prescriptive Measurement....55
Performance Measurement....59
Incentive Code Enforcement....61
Civil Codes....63
Sustainable Code Elements....68
Vision....68
Goal....68
Action....69
Mechanism....69
Indicator....70
Baseline....71
Target....71
Distribution....72
Evaluation....72
Supporting Elements....74
Chapter 5: Analysis....76
Comparative Analysis....76
Organization Missions....76

Metric Outcomes, Accessibility, Incentives, and Sustainability.....80
Metric Structure 87
Metric Categories.....90
Content Analysis.....92
Chapter 6: Discussion 100
Implementation 100
Metric Development 104
LEED for Neighborhood Development.....105
The Healthy Development Measurement Tool.....107
Appendix A: Content Analysis Codebook for Sustainability Metrics.....112
Appendix B: Mission Statements.....115
LEED-ND Organizations.....115
U.S. Green Building Council's Mission 115
U.S. Green Building Council's Vision 115
U.S. Green Building Council's Preamble.....115
U.S. Green Building Council's Guiding Principles.....116
Congress for the New Urbanism's Mission.....116
Natural Resources Defense Council's Mission.....117
LEED Mission 117
LEED Strategic Goals.....117
HDMT Organizations 118
San Francisco Department of Public Health Mission.....118
Environmental Health Section Mission 119
Program on Health, Equity and Sustainability's Mission.....119
Program on Health, Equity and Sustainability's Guiding Principles and Core Values.....120
Urban Health and Place Team's Description.....120
Appendix C: Content Analysis Data.....122
Bibliography 132

List of Tables

Table 1: Initial Content Analysis Coding Scheme 29

Table 2: Final Content Analysis Coding Scheme 31

Table 3: Summary of Framework Scales 43

Table 4: Summary of Framework Types 51

Table 5: Summary of Credits and Objectives by Category 92

Table 6: Manifest Content by Goal Category Expressed as a Percentage of Total Credits/Objectives within Each Metric 93

Table 7: Latent Content by Goal Category Expressed as a Percentage of Total Credits/Objectives Related to That Goal Category 94

Table 8: Manifest and Latent Content by Goal Topic Expressed as Percentage of Total Credits/Objectives within Each Metric 98

Table 9: LEED-ND Credit and HDMT Objective Names 122

Table 10: Content Analysis for LEED-ND Prerequisites and Credits in the Smart Location and Linkage Category 125

Table 11: Content Analysis for LEED-ND Prerequisites and Credits in the Neighborhood Pattern and Design Category 126

Table 12: Content Analysis for LEED-ND Prerequisites and Credits in the Neighborhood Pattern and Design Category Continued 127

Table 13: Content Analysis for LEED-ND Prerequisites and Credits in the Green Infrastructure and Buildings Category 128

Table 14: Content Analysis for LEED-ND Prerequisites and Credits in the Green Infrastructure and Buildings Category Continued 129

Table 15: Content Analysis for HDMT Objectives in the Environmental Stewardship; Sustainable and Safe Transportation; and Social Cohesion Categories 130
Table 16: Content Analysis for HDMT Objectives in the Public Infrastructure/Access to Goods and Services; Adequate and Healthy Housing; and Healthy Economy Categories 131

List of Figures

Figure 1: Hierarchy of Framework Scales.....44

Figure 2: Economic Code Classification Framework 55

Chapter 1: Introduction

The built environment has a great impact on both environmental quality and public health. The precise form of the built environment is largely shaped by both tacit and written codes reflecting the present values of those who created them. While the sustainability movement has largely embraced the goals of improving both environmental and human health, the corresponding professional fields have not yet fully recognized the shared opportunity between their fields. The purpose of my thesis is to compare the approaches of the environmental and public health fields in creating sustainable neighborhoods through the process of developing and implementing codes and to quantify the content of these codes as it relates to both fields.

Chapter 2 presents a brief history of the evolution of the various branches of sustainability, focusing particularly on the environmental and public health movements in their various incarnations throughout the past century, including the ecological modernization movement, environmental justice movement, and built environment and public health movement. It also provides a brief overview of the existing research on the connections between the built environment and public health.

Chapter 3 introduces the two codes that will be compared: the LEED for Neighborhood Development (LEED-ND) rating system developed by the U.S. Green Building Council and the Healthy Development Rating Tool (HDMT) developed by the San Francisco Department of Public Health. It also details the particular methodology used for conducting both a comparative analysis and content analysis of the two codes.

Chapter 4 outlines various framework scales and types; techniques for measuring and enforcing code compliance; and recommended elements for inclusion in codes relating to the design and evaluation of neighborhoods environments.

Chapter 5 presents the results of both the comparative analysis and content analysis. The comparative analysis highlights the particular strengths and weaknesses of the framework implemented in each of the two codes, while the content analysis quantifies the percentage of code elements explicitly related to environmental and human health.

Finally, Chapter 6 addresses how the analyzed codes could be consistently implemented through integration into the neighborhood planning process and reflects upon observed trends throughout the development process of both codes.

Chapter 2: Environmental and Public Health Movements

Present sustainability discourse can be largely divided into two distinct yet related movements that focus on the health of the environment and the health of humans. In general, these two movements are referred to as the environmental and public health movements; however, both have evolved greatly in name, values, and approach and in their relationship to each other over the past century.

ENVIRONMENTAL MOVEMENTS

Historically, the environmental movement has appealed to those in the upper class who have had the resources to devote to the sanctity of nature through the preservationist and conservationist movements in the 1900s and the traditional environmental movement in response to industrial chemicals in the 1960s and 1970s.[1] Modern incarnations of the environmental movement have sought to reframe the historical environmental values in a manner that resonates with present segments of society. Three particular branches of the environmental movement will be examined in more detail: the ecological modernization movement, the environmental justice movement, and the built environment and public health movement.

Ecological Modernization Movement

The most mainstream of the movements is referred to as "ecological modernization" by Andrew Jamison amongst others.[2] This movement seeks to reframe the environmental movement in economic terms, so as to be compatible with our capitalistic society. Historically, society has relied heavily upon the trade-off theory for

[1] Luke W. Cole and Sheila R. Foster, *From the Ground Up: Environmental Racism and the Rise of the Environmental Justice Movement*, Critical America (New York: New York University Press, 2001), 28–29.

[2] Andrew Jamison, *The Making of Green Knowledge: Environmental Politics and Cultural Transformation* (New York: Cambridge University Press, 2001).

analysis of the environmental movement, whereby environmental quality necessarily comes at the expense of economic prosperity.[3] Thus, it has become ingrained that actions that benefit the environment will end up requiring an economic sacrifice so they must be performed for some other magnanimous reason. The ecological modernization movement has helped greatly to overcome trade-off theory by demonstrating that environmentally beneficial actions can simultaneously be economically advantageous.

The ecological modernization movement was popularized in the book, *Natural Capitalism*, by Hawken, Lovins, and Lovins.[4] They explain that, in addition to factoring human, financial, and manufactured capital into industrial economic analysis, we must also factor in natural capital "made up of resources, living systems, and ecosystem services."[5] Their premise is that consuming natural capital in the interest of increasing financial capital and calling that a profit is false accounting. In other words, temporarily gaining income and permanently losing the natural resources required to continue generating that income in the future only appears logical if you completely externalize natural capital from the accounting system.

One disadvantage of the ecological modernization movement is that it appeals only to those who have sufficient knowledge, capital, and time to make upfront investments in order to benefit economically in the future by investing in the environment. It was largely designed to convince industries and government organizations to shift their business models to be more environmentally-friendly, while

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[3] Andrew Feenberg, "Incommensurable Paradigms: Values and the Environment," in *Pragmatic Sustainability: Theoretical and Practical Tools*, ed. Steven A. Moore (London; New York, NY: Routledge, 2010).

[4] Paul Hawken, Amory Lovins, and L. Hunter Lovins, *Natural Capitalism: Creating the Next Industrial Revolution* (New York: Back Bay Books, 1999).

[5] Ibid., 4.

still maintaining their bottom line. In that respect, the ecological modernization movement is reaching the same class of people who already had the luxury to invest in the environment in the first place. The difference is that it is no longer necessary for businesses to agree with the movement in order to embody its values in their practices, as they can justify it on a purely economic basis. In fact, Jamison and others criticize the movement as a form of "greenwashing", whereby companies cultivate an environmentally-responsible public image for the sole purpose of increasing their profits, while continuing to ignore environmental values and social equity.[6]

As such, the movement does not necessarily force a change in societal values (though widespread implementation of any practice will inevitably alter the cultural norm), but it does provide a framework for those who do not necessarily agree with the values of the environmental movement to work towards the same goals for different reasons. While many large corporations and well-to-do individuals can benefit greatly from the ecological modernization movement, it fails to reach a large portion of the population necessary for widespread change.

Environmental Justice Movement

The environmental justice movement has reached a very different portion of the population than the ecological modernization movement by integrating values developed in the civil rights movement and anti-toxics movement to reframe the environmental movement in terms of social equity.[7,8] Frequently, the most vulnerable portion of the

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[6] Jamison, *The Making of Green Knowledge: Environmental Politics and Cultural Transformation*.

[7] Cole and Foster, *From the Ground Up: Environmental Racism and the Rise of the Environmental Justice Movement*, 20–30.

population bears the greatest burden in terms of the negative environmental and health impacts of industrialization. While the affluent can afford to relocate their homes and pay for transportation over longer distances, those who are most negatively affected often cannot. As natural resources become scarcer due to unsustainable practices, it is those same segments of the population who will be less likely to afford any associated rising costs of necessities or the healthcare required to address the effects of living in an environment that is detrimental to their health.

The U.S. Environmental Protection Agency believes that environmental justice "will be achieved when everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work."[9] As indicated in the EPA definition, one of the key aspects separating this movement from others related to environmental and human health is its emphasis on the critical importance of local knowledge and participatory decision-making.[10]

Similar to the ecological modernization movement, a disadvantage of the environmental justice movement is that it is limited in scope to those typically subjugated to inequitable environments and has failed to widely shift cultural values. A great advantage of the movement is that if our society ultimately gets to the point where no one, no matter how vulnerable, is willing to tolerate the negative impacts of

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[8] David Naguib Pellow and Robert J. Brulle, "Power, Justice, and the Environment: Toward Critical Environmental Justice Studies," in *Power, Justice, and the Environment: A Critical Appraisal of the Environmental Justice Movement*, ed. David Naguib Pellow and Robert J. Brulle (Cambridge, MA: The MIT Press, 2005), 3.

[9] U.S. Environmental Protection Agency, "Environmental Justice," *U.S. Environmental Protection Agency*, November 21, 2012, http://www.epa.gov/environmentaljustice/.

[10] Jason Corburn, *Street Science: Community Knowledge and Environmental Health Justice*, Urban and Industrial Environments (Cambridge, MA: The MIT Press, 2005).

industrialization and development, we will be forced to come up with sustainable alternatives which minimize the burden that anyone must bear.

Built Environment and Public Health Movement

Finally, there is a newly emerging movement that reaches yet another segment of society by reframing the environmental movement in terms of human health. The built environment and public health movement brings attention to the various mechanisms by which the form of the built environment can facilitate or hinder lifestyle behaviors that impact chronic health. The origin of this movement will be further described in the following section on public health movements.

The purpose of this paper is not to provide a comprehensive overview of the hundreds of published studies demonstrating the links between the built environment and public health, as such compendiums have already been written. Two good examples are *Health and Community Design* and *Understanding the Relationship Between Public Health and the Built Environment*, a report commissioned by the LEED-ND core committee as a resource for the development of its code, which was largely cited throughout the HDMT as well.[11,12] Though these resources exist for detailed reference, basic knowledge of the connections that have already been researched will provide a better understanding of the purpose of the codes later analyzed in this paper. All of the following relationships have been summarized from the detailed explanations and citations in Ewing and Kreutzer.[13]

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[11] Reid Ewing and Richard Kreutzer, *Understanding the Relationship Between Public Health and the Built Environment: A Report Prepared for the LEED-ND Core Committee*, May 2006, http://www.usgbc.org/ShowFile.aspx?DocumentID=3901.

[12] Lawrence Frank, Peter Engelke, and Thomas Schmid, *Health and Community Design: The Impact of the Built Environment on Physical Activity* (Washington, DC: Island Press, 2003).

The majority of the effects of the design of the built environment on health are derived from the overall compactness and mixture of land uses and the design of the transportation networks. All of these factors impact both the frequency and distance people drive. The greater the frequency and distance people must drive, the greater the levels of air pollution, which affects respiratory health and increases asthma and death rates. Exposure to air pollutants can also trigger heart attacks in at-risk populations and increase risk of stroke, cancer, and premature births. In addition to air pollution, traffic volume and speed, along with the design of the street environment, impacts the frequency of fatal and non-fatal traffic accidents.[14]

The variety of land uses, proximity of recreational facilities, attractiveness of streets, and perception of safety, along with the convenience of walking and biking are associated with physical activity levels which impact the risk of heart disease, stroke, cancer, osteoporosis, diabetes, and depression.[15]

Finally, time spent commuting, walkability, availability of public spaces, and city size are all correlated to social capital. In addition to prolonged life; better cardiovascular, mental, and overall health; and faster recovery from illness, these benefits of social capital can help to offset any detrimental effects of the built environment.[16]

PUBLIC HEALTH MOVEMENTS

Just like the environmental field, the public health field has evolved dramatically over the past two centuries in response to shifting demographics, diseases, and societal

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[13] Ewing and Kreutzer, *Understanding the Relationship Between Public Health and the Built Environment: A Report Prepared for the LEED-ND Core Committee*.

[14] Ibid., 3–67.

[15] Ibid., 69–88.

[16] Ibid., 89–99.

values. The theory of epidemiologic transition, first outlined by Omran in 1971, provides a helpful framework for discussing these shifts by identifying the stages of epidemiology commonly experienced by all countries as they develop.[17]

The first stage of Omran's epidemiologic transition, spanning throughout human history until the beginning of the nineteenth century, was the *Age of Pestilence and Famine*, which was characterized by high and fluctuating birth and death rates and a lack of sustained population growth.[18] Most deaths during this period were the result of epidemics of infectious diseases. Death due to war and famine was also common. During this time, the field of public health, as we know it, had not yet been established.

The Age of Receding Pandemics began during the mid-nineteenth century.[19] During that time, advances in sanitation, housing, medicine, and nutrition led to dramatic decreases in death rates, which resulted in rapid population growth. The public health field became involved in shaping the built environment during this period, as it was determined that many diseases had environmental causes.

The final stage of Omran's epidemiologic transition was the *Age of Degenerative and Man-Made Diseases*, which began during the mid-twentieth century.[20] The population stabilized as birthrates fell to match death rates and most deaths were the result of chronic diseases such as cardiovascular disease and cancer. During that time, the work of many public health professionals shifted away from environmental factors to focus on the individual behaviors largely responsible for these chronic diseases. Instead

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[17] Abdel R. Omran, "The Epidemiologic Transition: A Theory of the Epidemiology of Population Change.," *Milbank Quarterly* 83, no. 4 (December 2005): 731–757.

[18] Ibid., 737.

[19] Ibid., 737–741.

[20] Ibid., 738.

of focusing on changing environmental contributors to disease, there was an emphasis on patient education regarding lifestyle behaviors including nutrition, exercise, and smoking.

Several scholars have proposed a fourth stage of epidemiologic transition called the *Age of Delayed Degenerative Diseases* to reflect present increases in life expectancies and dramatic shifts in the age of the population.[21] Though the health problems experienced during this stage are no different than the chronic diseases from the previous stage, the manner in which the public health movement is responding is beginning to shift back towards identifying and addressing environmental causes of chronic disease.

There are at least two significant factors that contributed to this renewed interest in the relationship between the built environment and public health. The first factor was a report issued by the Surgeon General in 1996, titled *Physical Activity and Health.*[22] Prior to that time, only the benefits of vigorous activity had been widely tested, as physiological experiments were geared primarily towards improving the performance of athletes. Health professionals recommended individuals get at least 20 minutes of moderate to vigorous activity at least three times per week and the phrase "no pain, no gain" was widely promoted.[23,24]

The Surgeon General's report dramatically shifted the conception of what amount and type of physical activity is most beneficial to health. Though a minimum of 30

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[21] S. Jay Olshansky and A. Brian Ault, "The Fourth Stage of the Epidemiologic Transition: The Age of Delayed Degenerative Diseases," *The Milbank Quarterly* 64, no. 3 (1986): 355–391.

[22] U.S. Department of Health and Human Services, *Physical Activity and Health: A Report of the Surgeon General* (Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996).

[23] Russell R. Pate et al., "Physical Activity and Public Health: A Recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine," *Journal of the American Medical Association* 273 (1995): 402–407.

[24] Frank, Engelke, and Schmid, *Health and Community Design: The Impact of the Built Environment on Physical Activity*, 39.

minutes of daily physical activity were still recommended, it was found that moderate activity distributed over several short 10 minutes intervals was equally beneficial for addressing chronic disease and overall health. The significance of these findings is that they show people can meet physical activity recommendations by walking or biking a few times a day and these forms of transportation can be easily promoted or discouraged based on the form of the urban environment. Even those who cannot afford to set aside time dedicated to exercise can still meet recommendations through purposeful walking and biking to work, school, and shopping centers.

A second significant factor that has contributed to a renewed interest in the built environment's impact on public health was a large grant program established by the Robert Wood Johnson Foundation (RWJF). Based on the evidence that active living (walking, biking, and taking the stairs, etc.) is beneficial to health and that less than half of Americans were meeting recommendations for physical activity, despite decades of emphasis on its importance, RWJF developed the Active Living Research program (ALR) and launched it in 2001 by providing $12.5 million for research through 2006. ALR was renewed in 2007 for another five years to provide an additional $15.4 million of research funding. The goals of ALR were:

> (1) to establish a strong research base regarding the policy and environmental correlates and determinants of physical activity […]; (2) to help build a transdisciplinary field of physical activity and environmental policy research and a vibrant community of researchers; and (3) to facilitate the use of research to inform policy action and public health advocacy.[25]

Prior to the availability of these ALR grants, little scientific research existed regarding modern links between physical activity and the built environment. The significant body

[25] C. Tracy Orleans et al., "History of the Robert Wood Johnson Foundation's Active Living Research Program: Origins and Strategy," *American Journal of Preventive Medicine* 36, no. 2S (February 2009): S3–S4.

of literature funded by these grants led to a strong evidence base justifying further study and collaboration between design and public health professionals.

Most sustainability movements actively acknowledge and combine some form of the environmental and public health movements, but none have managed to drastically transform American society. Feenberg explains that civilizational change arises when society comes to value something so much that a dollar value can no longer be assigned to it, as it cannot be tolerated under any circumstances.[26] At present, many people share in some of the ultimate goals of the sustainability movement, but still largely see them at conflict with the economy, culture, or convenience. In other words, our society has not yet come to the point where we value either the health of the environment or its associated effects on our own health to the point where we will no longer try to balance these costs against the profits of development and come up with alternatives that eliminate these costs altogether.

It is my belief that furthering the sustainability movement to the point where it ultimately reshapes the tacit codes of society will require reframing the wide variety of environmental and public health movements previously discussed in such a way that their tremendous overlap is actively recognized to engage a wider audience with diverse values in addressing the same problems. By concretely illustrating how the goals of the wider sustainability movement are related to the beliefs and values of each specialty field, these fields may be more inclined to participate cooperatively and contribute their expertise and resources to developing mutually beneficial solutions.

[26] Feenberg, "Incommensurable Paradigms: Values and the Environment."

Chapter 3: Methodology

RESEARCH PARADIGM

Before going into the particular methods used, it is important in any research to understand the paradigm within which the research is conducted. The primary research method used in my study is content analysis, which frequently follows the positivist paradigm;[27] however, my personal approach to research follows a postpositivist paradigm, which recognizes that each researcher's existing knowledge and personal values influence the manner in which the study is designed and conducted, whether or not he or she is consciously aware of this influence. Ultimately, this bias also has implications on the particular data that is observed and how it is interpreted and presented. Throughout the methods section, I highlight how my own knowledge, values, and limitations have potentially impacted both the study design and results.

Both positivist and postpositivist paradigms "work from within a realist and critical realist ontology and objective epistemologies, and they rely on experimental, quasi-experimental, survey, and rigorously defined qualitative methodologies."[28] The postpositivist paradigm operates within the ontology of critical realists who state:

> There is a world of events out there that is observable and independent of human consciousness. They hold that knowledge about this world is socially constructed. Society is made up of feeling, thinking human beings, and their interpretations of the world must be studied. Critical realists reject a correspondence theory of truth. They believe that reality is arranged in levels and that scientific work must go beyond statements of regularity to analysis of the mechanisms, processes, and structures that account for the patterns that are observed.[29]

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[27] Kimberly A. Neuendorf, *The Content Analysis Guidebook* (Thousand Oaks, California: Sage Publications, Inc., 2001).

[28] Norman K. Denzin and Yvonna S. Lincoln, "The Discipline and Practice of Qualitative Research," in *The SAGE Handbook of Qualitative Research*, ed. Norman K. Denzin and Yvonna S. Lincoln, Third ed. (Thousand Oaks, California: Sage Publications, Inc., 2005), 24.

[29] Ibid., 13.

Though I approached the content analysis methodology itself from a postpositivist paradigm, the codes I am studying are not natural phenomena or behaviors existing outside of the constructs of society, but rather written artifacts constructed by particular social groups to purposefully change the course of society. For this reason, the significance of my analysis is based on assumptions of social constructivists who assert that the technologies embedded in the codes I am studying are constructed by "'relevant social groups […] who share a meaning of the artifact. This meaning can then be used to explain particular developmental paths."[30] By studying how professionals in the environmental and public health fields have constructed their codes, I am attempting to assess this shared meaning and advocate that it be explicitly stated to facilitate further sharing and critiquing by a wider audience. In addition, social constructivists assert "different social groups associate different meanings with artifacts leading to interpretative flexibility appearing over the artifact. The same artifact can mean different things to different social groups of users."[31] In this vein, I am acknowledging the possibility that my interpretation of the meaning of the codes could be different from the interpretation of others and from that intended by the designers. With my research paradigm in mind, I will now discuss the methodology used in my study.

RESEARCH QUESTIONS

In light of the evidence that both the environmental and public health fields are actively researching and promoting sustainable neighborhoods, I was interested in measuring how neighborhood-level codes generated in each field compare in approach,

[30] Ronald Kline and Trevor Pinch, "The Social Construction of Technology," in *The Social Shaping of Technology*, ed. Donald MacKenzie and Judy Wajcman (Maidenhead, England: Open University Press, 1999), 113.

[31] Ibid.

organization, scope, and goals. Based on my prior experience with both fields, my hypothesis was that each field would exhibit a bias towards goals which explicitly support their own field, but that a significant portion of their goals would simultaneously support the other field.

Since both fields recognize a certain extent of overlap in their interests, I also wanted to explore to what degree collaboration between the two fields is already reflected in the neighborhood-level codes they have developed and to explore how much latent potential for further collaboration exists within the codes as they are currently written. Finally, I would like to reflect upon how each movement, and the sustainability movement in general, might benefit from such collaboration.

COMPARATIVE ANALYSIS

The first portion of my research provides a comparative analysis of the structure and content of neighborhood-level sustainability codes developed by the environmental and public health movements. Both the codes and the organizations that developed them were analyzed in the context of the sustainability frameworks and neighborhood code elements that I outline in Chapter 4.

Code Selection

In any comparative analysis, it is important to establish grounds for comparison, or rationale for the selection of the items being compared. In order to address my research questions, I wanted to compare the codes generated by the environmental movement and the public health movement, so I selected one code to be reflective of each movement. The following provides my rationale for the selection of these two codes.

As illustrated in Chapter 2, it is at the community level that changes to the built environment can have the most dramatic impacts on the chronic health crisis facing us

today. For this reason, I chose to focus on codes that were specifically designed to address sustainable design at a community or neighborhood scale. In addition, because progress in the field of sustainable neighborhood design varies so greatly amongst countries, I chose to focus specifically on the current state of codes in the United States, though reflection upon the codes from other countries will undoubtedly be useful for analyzing what other alternatives have proved effective and what may be possible in the future.

Though the present environmental and public health movements are both in the process of creating codes to promote sustainability at the neighborhood level, these codes in both fields are still in their infancy. As such, the grounds for comparison of the two codes is due more to the dearth of fully developed neighborhood codes than my personal belief that the selected codes should be considered to be truly representative of the two fields as a whole. Because both selected codes have not been universally adopted as law and because they are both used to quantify measures of sustainability, rather than to mandate particular standards, I will refer to them as metrics.

The metric that has been selected as representative of the environmental movement is the LEED for Neighborhood Development Rating System (LEED-ND) developed by the U.S. Green Building Council (USGBC) in collaboration with the Congress for the New Urbanism (CNU) and the Natural Resources Defense Council (NRDC). USGBC is representative of the ecological modernization movement, believing that green building principles can simultaneously benefit the environment and the economy.[32]

[32] U.S. Green Building Council, "About USGBC," *U.S. Green Building Council*, 2012, https://new.usgbc.org/about.

Since its inception in 1993, USGBC has been developing and increasing the number of rating systems designed to evaluate the sustainability of particular building types. LEED-ND is only one of several rating systems implemented by USGBC. The Pilot Version of LEED-ND was released in 2007 and, as of 2011, 239 projects were registered.[33] The LEED rating systems have become the nationwide standard for sustainable design. Since 2003, all projects involving new construction or significant renovation by the U.S. General Services Administration were required to achieve a minimum rating of LEED Certified, with a target rating of LEED Silver. As of 2010, federal buildings are required to achieve LEED Gold, thereby making LEED the standard for all national public buildings.[34,35] Numerous other localities have followed the lead of the national government and have mandated LEED certification for local public buildings "beginning with the City of Seattle in 1998."[36] In addition, though numerous rating systems for evaluating sustainability have been developed, most specifically for the sustainability of individual buildings, LEED-ND is the first and only nationwide metric, to my knowledge, that focuses specifically on sustainability at the neighborhood level. On its website, USGBC claims that LEED-ND "integrates the principles of smart growth, urbanism and green building into the first national system for neighborhood design."[37]

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[33] U.S. Green Building Council, "LEED for Neighborhood Development Registered Pilot Projects and Plans List - Updated 07/14/11", July 14, 2011, http://www.usgbc.org/ShowFile.aspx?DocumentID=2960.

[34] U.S. General Services Administration, "Sustainable Design," *U.S. General Services Administration*, April 23, 2012, http://www.gsa.gov/portal/content/104462.

[35] U.S. General Services Administration, "GSA Moves to LEED Gold for All New Federal Buildings and Major Renovations," *U.S. General Services Administration*, October 28, 2010, http://www.gsa.gov/portal/content/197325.

[36] Thor Peterson, "A Comparative Analysis of Sustainable Community Frameworks" (ICLEI—Local Governments for Sustainability, September 14, 2008), 6, http://www.icleiusa.org/action-center/affecting-policy/Sustainability%20Framework%20Analysis.pdf.

The metric that has been selected to represent the public health movement is the Healthy Development Measurement Tool (HDMT) developed by the Urban Health and Place Team in the Program on Health, Equity and Sustainability (SFPHES) within the Environmental Health Section of the San Francisco Department of Public Health (SFDPH). SFDPH is representative of the built environment and public health movement, embodying the belief that the design of the built environment within each neighborhood plays a critical role in the health of its residents.[38] The HDMT comes out of the tradition of a much broader method of providing quantitative and qualitative evidence-based predictions about the impacts of a particular plan, in the form of a health impact assessment (HIA), similar to the environmental impact assessments conducted by the environmental fields, which are often required by law as part of any major development project.

Unlike LEED-ND, established methods in conducting HIAs do not lay out the precise goals which should be achieved and the particular actions which should be implemented to achieve those goals. Instead, they set out guidelines for establishing the scope of health effects to be considered, assessing the risks and benefits of the plan in question, developing recommendations based on these assessments, and reporting these results and ultimately monitoring the effect of the recommendations on the project outcome.[39] As a result, it is very easy for localities to customize HIAs to the particular

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[37] U.S. Green Building Council, "USGBC: LEED for Neighborhood Development," *U.S. Green Building Council*, 2011, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148.

[38] San Francisco Department of Public Health, "Urban Health & Place," *Program on Health Equity and Sustainability*, 2012, http://www.sfphes.org/component/content/article/2-uncategorised/149-urban-health-and-place.

[39] Centers for Disease Control and Prevention, "Health Impact Assessment," *Centers for Disease Control and Prevention*, August 22, 2012, http://www.cdc.gov/healthyplaces/hia.htm.

needs, conditions, and values of their individual community, but there is no one national standard by which different projects can be compared or recognized. The HDMT is the first HIA in the U.S., to my knowledge, to dictate particular evidence-based standards and targets in a comprehensive system for the evaluation of health that can be applied to any neighborhood nationwide, in much the same manner that LEED-ND has done. The HDMT has been adapted by at least seven other localities across the country, providing strong evidence that it is already serving as an evaluation framework nationwide, if not becoming a national standard for conducting neighborhood HIAs.[40]

Code Comparison

To begin the comparative analysis of LEED-ND and the HDMT, the organizations responsible for the creation of the metrics were studied to determine what values they may have embedded in the metrics themselves. Next, the metrics were compared in terms of the outcomes and societal incentives for participation, along with the ease of implementation (regarding accessibility of documentation, financial and logistical requirements, necessity for implementation by experts, and adaptability to differing communities). Finally, the general structure of the metrics was compared, regarding both the topical organization of the goals and the presence of particular code elements which are further outlined at the end of Chapter 4.

CONTENT ANALYSIS

Following the comparative analysis of the overall structure and implementation of the two metrics, the primary method that I used to analyze the actual content of the metrics themselves was content analysis. Both the definition and methods of content

[40] San Francisco Department of Public Health, "Adaptations Elsewhere," *Sustainable Communities Index*, 2012, http://www.sustainablesf.org/webpages/view/35.

analysis vary amongst researchers. Berelson provided one of the earliest definitions of content analysis as "a research technique for the objective, systematic, and quantitative description of the manifest content of communication."[41] More recent scholars, such as Neuendorf, have defined content analysis more rigorously as:

> a summarizing, quantitative analysis of messages that relies on the scientific method (including attention to objectivity-intersubjectivity, a priori design, reliability, validity, generalizability, replicability, and hypothesis testing) and is not limited as to the types of variables that may be measured or the context in which the messages are created or presented.[42]

As this more recent definition begins to make obvious, rigorous content analysis conforms to the scientific method based on the positivist paradigm. I shall further discuss each of the tenets of the scientific method mentioned by Neuendorf in greater detail, as they apply to my research, towards the end of this chapter.

Communication Typology

Neuendorf categorizes content analysis communication contexts into individual, interpersonal, group, organizational, and mass messaging. She adds an additional category of applied contexts that transcend the aforementioned categories by placing the messages in the context of a very particular set of "norms, values, behaviors, legal constraints, and business practices."[43] I believe the metrics I analyzed are a prime example of applied contexts, because they contain embodied values and attempt to dictate particular behaviors and influence business practices by establishing legal constraints. She also states that "some applications of content analysis may be highly practical […]

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[41] Bernard Berelson, *Content Analysis in Communication Research* (New York: Hafner, 1952), 18.

[42] Neuendorf, *The Content Analysis Guidebook*, 10.

[43] Ibid., 22.

rather than attempting to answer questions of theoretical importance."[44] I believe this statement also applies to my study, in that illustrating a specific number of shared goals between the two fields provides a very practical argument for a specific degree of collaboration based on those particular goals.

Content can also be categorized on a continuum of manifest content to latent content. Manifest content is that which is directly observable and countable. On the other hand, latent content cannot be observed directly, but can be generated from composites of several other manifest variables. Neuendorf also notes that there is not always a clear distinction between the two content types and that "it is perhaps more useful to think of a continuum from 'highly manifest' to 'highly latent' and to address issues of subtlety of measurement for those messages that are very latent."[45] As will be clarified later, I chose to analyze both the manifest and latent content of the two metrics, but, since latent content can be more subjective, I recorded its presence separately from manifest content. Since a significant portion of my thesis aims to promote transparency in codes, I believe it is important to clearly identify how much content is expressed in manifest versus latent form. Manifest content is likely to be successfully interpreted by future readers, while latent content, which may often seem obvious to the original writers of code, will inevitably be lost if the codes are implemented across many generations, cultures, and places without continuous reevaluation.

Unit of Analysis

For this content analysis, the unit of data collection was each "credit" in LEED-ND and each "objective" in the HDMT. The unit of analysis for which results were

[44] Ibid.

[45] Ibid., 23.

summarized and reported was the overall metric. The data collected measured only content attributes, which describe the substance of the text, versus form attributes, which dictate the particular physical format of the communication.[46] Though not studied within the content analysis itself, form attributes are discussed in the general comparative analysis which precedes the content analysis. Finally, though other forms of communication can be measured, the particular medium of content analysis in this study will be text analysis, based on written communication.

Coding Scheme

The section that follows provides a detailed discussion of the coding methodology that was used. A simplified version of the coding scheme is presented independently in Appendix A.

Unit of Data Collection: Each individual credit/objective in the metric.

Credit/Objective ID: Fill in the full name of the credit/objective as listed in the metric.

Action: Indicate whether or not an action is explicitly mentioned in the credit/objective relating to each of the three goal categories: environmental health, human health, and societal health.

> *1 – Manifest:* An action with the stated or known potential to impact the goal category through a particular mechanism is explicitly mentioned in the text.
>
> *-1 – Latent:* An action with the stated or known potential to impact the goal category through a particular mechanism is not explicitly mentioned in the text, but a mechanism and/or a goal related to that goal category is explicitly mentioned in the text and you are aware of a potential action that would help achieve the stated mechanism and/or goal.

[46] Ibid., 24.

0 – Absent: An action with the stated or known potential to impact the goal category through a particular mechanism is not explicitly mentioned in the text and neither is a mechanism nor goal explicitly mentioned in the text that relate to the goal category.

Description - An action is defined as a specific, feasible, and describable step that can be implemented with the intent of achieving a specific goal. Example actions are described in Chapter 4.

Mechanism: Indicate whether or not a mechanism is explicitly mentioned in the credit/objective relating to each of the three goal categories: environmental health, human health, and societal health.

1 – Manifest: A mechanism resulting in the goal category due to a particular action is explicitly mentioned in the text.

-1 – Latent: A mechanism resulting in the goal category due to a particular action is not explicitly mentioned in the text, but an action and/or goal related to that goal category are explicitly mentioned in the text and you are aware of a hypothesized or proven mechanism which links to the manifest action or goal within that goal category.

0 – Absent: A mechanism resulting in the goal category due to a particular action is not explicitly mentioned in the text and neither is an action nor goal explicitly mentioned in the text that relate to the goal category.

Description – A mechanism is the specific manner in which the dictated action is hypothesized or has been proven to result in the intended root-level goal. Example mechanisms are provided in Chapter 4.

Goal: Indicate whether or not a root-level goal is explicitly mentioned in the credit/objective relating to each of the three goal categories: environmental health, human health, and societal health.

1 – Manifest: A root-level goal related the goal category is explicitly mentioned in text.

-1 – Latent: A root-level goal related to the goal category is not explicitly mentioned in the text, but an action and/or mechanism which you know to result in the goal category are explicitly mentioned in the text.

0 – Absent: A root-level goal related to the goal category is not explicitly mentioned in text and neither is an action nor mechanism explicitly mentioned in the text that relate to the goal category.

Description - A goal is defined as an idealistic root-level objective related to human values that can be assumed to be shared by most people in most places at most times, assuming the absence of other competing values. For example, anything related to improving environmental quality or improving human health can be defined as a root-level goal, because most people would agree upon those objectives if all other constraints were removed.

One way to help determine whether the goal is a root-level goal is to determine whether or not the logic behind the goal would be apparent to anyone, even if they did not share in the values behind the goal. For example, though everyone may not believe that the health of humans should be prioritized over economic prosperity or environmental quality, most people would be able to understand why some might see this as an important goal.

As a counter example, many apparent goals are not actually root-level goals. For example, the logic behind the goal of having a compact development footprint or the goal of reducing vehicle miles traveled is not inherently obvious and cannot necessarily be agreed upon, even without competing factors. Some people may enjoy living in suburbs or rural regions with lots of property and some people love driving for pleasure. It is not these actions in themselves that are inherently bad, but, rather the implications of them. If the metric had said, "Reduce vehicle miles traveled to limit the amount of pollutants emitted into the air that degrade the environment and are harmful to human health," then the action (reduce vehicle miles), the mechanism (limit air pollution), and root level goal

(improve the environment and human health) are clear. On the other hand, if the metric simply states, "Reduce vehicle miles traveled," then the root-level goal is not explicitly stated. At first glance, it might seem as though reducing vehicle miles traveled is the goal, but I would argue that this is actually the action and that the root-level goal has not been explicitly stated, though it can be deduced as part of the latent content.

Goal Topic: Indicate whether or not all three metric components (action, mechanism, and goal) are explicitly mentioned in the credit/objective for each of the thirteen goal topics across the three goal categories as listed below.

> *1 – Manifest:* An action, mechanism, and goal related to the particular root-level goal topic are all explicitly mentioned in the text.
>
> *-1 – Latent:* At least one, but not all, of the three metric components (action, mechanism, and goal) related to the particular root-level goal topic is explicitly mentioned in the text.
>
> *0 – Absent:* No actions, mechanisms, or goals related to the particular root-level goal topic are explicitly mentioned in text.
>
> **Environmental Health Category Goal Topics**
>
> - Preserve the diversity of plant and animal species.
> - Conserve natural resources, such as fossil fuels.
> - Reduce water pollution and improve water quality.
> - Reduce air pollution and improve air quality.
>
> **Human Health Category Goal Topics**
>
> - Reduce the incidence of malnutrition and starvation.
> - Reduce the incidence, severity, and mortality of chronic diseases, including heart disease, stroke, cancer, diabetes, obesity, chronic lower respiratory diseases, and arthritis.
> - Reduce the incidence and mortality of infectious diseases, including waterborne and foodborne diseases.

- Reduce the incidence, severity, and mortality of mental illness and stress.

- Reduce the incidence of accidental injuries and death.

Societal Health Category Goal Topics

- Improve the health of the economy.

- Increase environmental justice so that a distinct portion of the population does not bear an inequitable burden of the environmental and human health costs associated with development and economic prosperity.

- Reduce crime and social disorder, including physical abuse, drug and alcohol abuse, and other behavioral problems.

- Increase access to cultural amenities; improve academic outcomes; and increase social capital, which includes civic participation, social cohesion, social interaction, and community building.

Error Checking: After coding each credit/objective, ensure that the following guidelines are followed to maintain uniformity in the coding process.

1. If the credit/objective is related to the goal category, then the action, mechanism, and goal should all be coded with a combination of 1's and -1's. If the credit/objective is not in any way related to the goal category, then the action, mechanism, and goal should all be coded with 0's. In other words, each credit/objective should be coded using either all 1's and -1's or all 0's.

2. For each credit/objective coded with 1's and -1's, at least one of the three metric components must be coded with a 1. In other words, at least an action, mechanism, or goal must be explicitly stated in order for that credit/objective to be considered related to the goal category.

3. In order for a particular goal topic to be coded with a 1, all three metric components related to the corresponding goal category must also have been coded with a 1. Conversely, if all three metric components related to a goal category were coded with 1's, then at least one of the corresponding goal topics must also be coded with a 1.

4. Note that when the action, mechanism, and goal for a particular goal category have been coded with a 1, that simply indicates that all three metric components are explicitly stated for at least one of the goal topics related to that goal category, which does not mean that all three metrics components are explicitly stated for every applicable goal topic within that goal category.

> Therefore, it is acceptable to code goal topics within the same goal category with a combination of 1's and -1's.

As stated before, a simplified version of the codebook without the detailed descriptions appears again in Appendix A. In the remainder of the chapter, I will discuss the degree to which my study meets each of Neuendorf's criteria for content analysis and will provide more insight into the process of developing the codebook and the rationale for its final form.

Intersubjectivity and A Priori Design

Neuendorf's first tenet of the scientific method is to establish the *objectivity* of the investigator to ensure that personal biases do not influence the results.[47] Many theorists and practitioners, including Neuendorf, acknowledge the tenets of social constructionism, which state that all knowledge is constructed and propagated within the context of a particular society which comes to collectively accept certain knowledge as true. This particular societal agreement on how true knowledge is obtained and validated is called *intersubjectivity*.[48]

Because my study follows the methods established by experienced practitioners in the field of content analysis and is being further reviewed by other researchers, I would hope that intersubjectivity has been upheld to the extent possible; however, true objectivity is more of an abstract ideal than something that can be achieved or proven through writing. Rather than professing that my results are true, I will strive for transparency in my research methods and attempt to disclose my personal interests to best allow future readers to determine the degree to which intersubjectivity has been upheld and the degree to which the results may still be applicable at the time of future review.

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[47] Ibid., 11.

[48] Ibid.

One of the primary means of establishing intersubjectivity is to design the variables and coding procedure *a priori*. Because a content analysis of sustainable neighborhood metrics has not previously been performed, a certain amount of inductive exploratory research had to be conducted on the format and type of content contained in the metrics in order to generate a relevant and appropriate coding procedure. Neuendorf acknowledges that "deduction based on past research, theories, and bodies of evidence within the current popular paradigm does not foster innovation," and, as such, exploratory research of this type should be conducted before finalizing the coding scheme.[49]

There are two main aspects of my study that were heavily influenced by inductive investigation prior to establishing the final coding procedure. Before beginning this study, I knew that I wanted to measure the degree to which actions, mechanisms, and goals, as they relate to both environmental and human health, were being expressed in the manifest content of the metrics. Because manifest content is, by its very definition, explicitly stated and easily observed, it is far less prone to the limitations of subjective interpretation by human coders. For this reason, I initially thought it best to limit the analysis to the manifest content of the metrics to best conform to the scientific method.

After beginning to read through the metrics, I realized that, while proposed actions were always elucidated in the manifest content, such a large portion of the mechanisms and goals were not explicitly stated, that the full potential for overlap and shared goals between the two metrics would not necessarily be exposed through manifest content alone, so I ultimately decided to measure both the manifest and the latent content. If the coding procedure first developed in this thesis is later carried out with multiple

[49] Ibid., 11–12.

coders, the decision to include latent content will have significant implications on the training of those coders, since consistent interpretation of the potential ability for a particular action stated in the metric to lead to an unstated mechanism and goal will inevitably require more thorough knowledge of the scientific literature within the environmental and public health fields.

The second major revision to my methods in light of my inductive investigation relates to the overall structure of the analysis. I had initially intended to conduct two separate components of the content analysis, as illustrated in Table 1. The first portion of the analysis was to be entirely deductive and would evaluate whether or not each credit or objective contained environment-related and/or health-related actions, mechanisms, and goals. The second portion of the analysis was to be entirely inductive to determine which general topical categories, such as chronic disease prevention, species preservation, and land conservation were addressed by each action. As I did not want to limit these topical categories to a pre-defined set before becoming familiar with the actual topics covered in the metrics, I first wanted to study the metrics inductively to generate a master list of the most applicable categories ahead of time. After generating this master list, I could then comprehensively review all the metrics to determine exactly how many actions supported each topic category.

	Environmental Health			**Human Health**			Specific
	Action	Mechanism	Goal	Action	Mechanism	Goal	Goal Topic
LEED-ND							
Credit 1							
Credit 2							
Credit 3							
HDMT							
Objective 1							
Objective 2							
Objective 3							

Table 1: Initial Content Analysis Coding Scheme

As I began testing the deductive analysis, I felt that merely indicating whether or not the goals, mechanisms, and actions addressed human health or environmental health was not granular enough to meaningfully highlight the commonalities and differences between the two fields. Simultaneously, in the early stages of inductively selecting the topical categories, I realized that the same broad-level goals were appearing repeatedly. Though I had initially intended to limit my study to environmental health and human health, there were also several goals that seemed primarily targeted towards what I will call societal health goals, so I decided to reflect this category in the coding scheme. The societal health category includes topics such as education, crime, environmental justice, and social cohesion. I also included economic goals in the societal health category, since the economy is an artificial construct of human society.

I found that integrating the two previously separate portions of the content analysis together into the final coding scheme made it significantly easier for the coder to systematically focus on the particular item being evaluated. To achieve this integration, I selected the top four or five most common root-level goals for environmental health, human health, and societal health and performed the deductive analysis for the presence of each of these 13 goals topics across all of the metrics, as shown in Table 2.

	Environmental Health							Human Health								Social Health						
	Action	Mechanism	Goal	Conserve species diversity	Conserve natural resources	Reduce water pollution	Reduce air pollution	Action	Mechanism	Goal	Reduce malnutirtion	Reduce chronic disease	Reduce infectious disease	Improve mental health	Reduce accidental injury/death	Action	Mechanism	Goal	Improve health of the economy	Environmental justice	Reduce crime	Improve social health
LEED-ND																						
Credit 1																						
Credit 2																						
Credit 3																						
HDMT																						
Objective 1																						
Objective 2																						
Objective 3																						

Table 2: Final Content Analysis Coding Scheme

The final method combining inductive and deductive methods allowed me to develop a coding scheme that would be broadly informed by the content of the codes so as to be relevant, but also to be finalized prior to any formal coding and analysis being carried out.

Intercoder Reliability

Since this content analysis relies upon human recognition and interpretation of written sustainability codes, there is likely to be some degree of variation in the results when the analysis is performed by different people due to varying levels of knowledge, assumptions, and biases. The *reliability* of the coding procedure is the extent to which the procedure generates the same results when it is repeated by different people. More specifically, the *intercoder reliability* is a measure of agreement between multiple coders.

Due to the limited scope of this research, I served as the only coder and the intercoder reliability of the coding procedure was not measured. Because of this

limitation, the actual coding method that was used in this study should not be assumed to be a reliable method, but rather to serve as a pre-established coding design from which to start testing the reliability and modifying the design for those who desire a more rigorous analysis method. One of the biggest contributions of my study is outlining a detailed coding method based on a high level of inductive research, thereby allowing future researchers to carry out completely deductive *a priori* studies on the increasing number of neighborhood-level sustainability codes that I believe will be produced in the near future. Future researchers will also be able to test the intercoder reliability of my coding scheme and any modified coding schemes without having the coding process itself influenced by the biases of the person who developed the coding scheme (though admittedly designer biases could be embedded in the coding scheme itself.)

Because the intercoder reliability of the coding procedure has not been established, the quantitative results of the content analysis should not be considered accurate in terms of the exact numbers generated, but any general trends that are observed should be considered significant enough to warrant investment in a more rigorous development and testing of coding instruments and repetitions of the study with multiple coders analyzing a greater breadth of codes from both fields.

What follows are my hypothesized potential effects on the quantitative results due to having a single coder. I do not predict there would be a significant effect on the quantitative results of the manifest content. The main effect would likely be on the quantitative results of the latent content. If I am aware of a hypothesized or proven connection between a stated action and an unstated mechanism and goal from existing literature, then I would feel confident that it is valid to enter this unstated mechanism and goal as latent content, but that does not mean there could not be other latent connections identified by other coders who are aware of other literature to which I have not been

exposed. For that reason, I would consider the quantitative results of my individually-conducted content analysis to be minimum results. In other words, I would predict that no matter who was performing the individual coding, the actual amount of latent content that could be agreed upon by a group of experts could be higher than was measured by the particular individual, but would not be lower. For this reason, I consider the number of connections to particular goals reported in my study to be a minimum number of connections as established by a single individual.

In fact, it would be an interesting study in itself to determine how interpretation of the codes may vary based on the background of the practitioner. Potential groups of coders to test could be recruited from both the environmental and public health fields, both who were and were not active in developing the code, both who have and have not used the code, along with a group of laypeople. One problem with the coding method, as written, is that it requires the coder to be able to identify at least one, often latent, goal category for each metric unit, in order for the presence of an action to be coded at all. Say, for example, that a coder could correctly identify a manifest action, but was not knowledgeable about any of the potentially related latent mechanisms or goals and, therefore, would not know under which goal category to code the action. One solution might be to allow for the coding of the presence of any actions, mechanisms, and goals, independently of their goal category. Unfortunately, while such a method would be useful in assessing the degree of transparency within the code, it would not allow for a quantitative assessment of the topical overlap in goals between the two fields of study, so I did not structure my coding procedure in such a way, thereby requiring a base level of knowledge in order to be implemented consistently.

I am passionate about the work of both fields and believe they are complimentary in nature, so I do not believe I have a strong leaning to one field or the other. I do have

more familiarity with the effects of the built environment on both environmental and human health than people who have not studied these topics and, therefore, may read additional meaning or implications into the latent content of the codes that others may not be aware of, though I tried to limit the measurements of manifest content to explicitly what was stated in the text. Overall, my hypothesis is that measurement of manifest content across all codes should be consistent, but that those familiar with the environmental and public health fields, including myself, would be able to detect greater latent content than the general public.

Generalizability

Generalizability is the extent to which the findings of the analysis are applicable to the larger population from which the sample content was drawn. In this case, generalizability would measure the extent to which the analysis of the particular two metrics I selected from each of the fields can be generalized to all the metrics generated from those two fields, or even more broadly, to the overall goals of the professionals in those fields. Generalizability is usually established by selecting both random subjects and then random units within those subjects for analysis.

Because these fields are still in their infancy, it was not possible, nor desirable, to pick random metrics for analysis, due to the limited number of metrics published regarding neighborhood-level sustainability. While a lack of randomization may be considered a weakness, in this case, it could also be considered a strength that most, if not all, of the neighborhood-level sustainability metrics existing in the US at the time of this writing have been analyzed. For this reason, it is also likely that these metrics represent the general trends within the professions as a whole, since there are no other major competing metrics within the same profession; however, the results can only be applied

to the two particular metrics analyzed with absolute certainty and caution should be taken in assuming those two metrics are representative of the two fields as a whole, especially as time passes and new neighborhood-level sustainability metrics are ultimately developed.

Because both LEED-ND and the HDMT were of manageable length, all analysis units (credits/objectives) of the metrics were analyzed, eliminating the need for a method of randomly sampling the units, so, in that respect, the results may certainly be generalized for the entirety of the two codes analyzed.

Replicability

Replicability is the degree to which the same results can be obtained by following the same methods to analyze different selections of codes in different contexts. Because all metric units were comprehensively coded, it is not possible to test a different sample of units from the same metrics and I will not be repeating the methods to analyze a different selection of metrics within this individual study, because there were no others that I discovered meeting the criteria of this study. However, all methods are outlined in detail, so the same procedures can easily be carried out by others whenever new neighborhood-level sustainability codes are developed.

Another issue is that the two fields are rapidly evolving and if the transparency and collaboration between the two fields that I am ultimately arguing for in this thesis is implemented, then I would hope that, indeed, different results would be obtained from analyzing the neighborhood sustainability codes of the future and that all of the shared goals between the fields would be stated explicitly. Another example would be to locate and analyze similar codes from other countries, but, again, I think that differences in

results may be more telling about the differences in collaboration between the fields in the respective countries, rather than a lack of replicability of the research methods.

Hypothesis Testing

There has not been sufficient study into the degree to which the metrics produced by the two fields overlap in the past for me to base my hypotheses on existing theory alone. For that reason I am not predicting to what degree a relationship exists between the fields, but rather using a research question to propose the existence of a hypothesized relationship to be quantified within this study.

Quantitative and Summarizing

In addition to following the scientific method, Neuendorf maintains that content analysis must be both quantitative and summarizing.[50] My study specifically quantifies the percentage of metric units which dictate actions, mechanisms, and goals, as they relate to environmental, human, and societal health in both the manifest and latent content of the metrics. It is also summarizing, because these counts can be summarized into generalized conclusions regarding the key variables that were selected for analysis.

LIMITATIONS

The inherent weaknesses of the methodology of this study have been examined in detail throughout this chapter. In summary, due to the limited scope of relying upon a single coder and the infancy of the development of neighborhood sustainability metrics, this study should be thought of as an exploratory analysis of the potential usefulness of implementing content analysis methodology to quantify shared goals within interdisciplinary fields.

[50] Ibid., 14–15.

Chapter 4: Built Environment Code Elements

Before comparing the two particular codes selected for analysis, I will review general approaches to coding for sustainability to establish the framework in which the analysis will be conducted. My focus throughout this exploration is based on my belief that codes which generate sustainable communities must, in themselves, be sustainable. In this regard, I define sustainability as the ability of a code and the processes that generate and enforce it to adapt to changing environmental conditions and shifting societal values. The opposite of a sustainable code is a stagnant code that is propagated throughout various regions and blindly upheld over time without reflection on its continued ability to meet the needs and values of the present society which it continues to influence.

In this chapter, I review various coding frameworks along with methods of measuring and enforcing code compliance and highlight the strengths and weaknesses of each type of framework in terms of sustainability. I then propose and summarize the elements I believe are necessary for any neighborhood code to successfully embody and promote sustainability.

SUSTAINABLE COMMUNITY FRAMEWORKS

There are currently efforts underway by ICLEI - Local Governments for Sustainability USA (formerly the International Council for Local Environmental Initiatives) to develop a "national, consensus-based framework for gauging the sustainability and livability of U.S. communities," called the STAR Community Index.[51] Through this program, ICLEI USA aims to influence local governments in much the

[51] ICLEI USA, "STAR Community Index," *ICLEI Local Governments for Sustainability USA*, 2010, http://www.icleiusa.org/programs/sustainability/star-community-index.

same way that LEED has influenced the building industry. As part of the program development, ICLEI USA commissioned a report by Thor Peterson titled *A Comparative Analysis of Sustainable Community Frameworks*. In this report, Peterson defines a sustainable community framework as:

> a program or approach by which an entity aims to evaluate the progress of itself or other entities with respect to performance in the arenas of environmental, human, and economic health. The framework must have defined boundaries (geographic or organizational) to allow for comparison, and indicators or other measures of evaluation.[52]

Peterson specifies that sustainable frameworks measure performance in the arenas of environmental, human, and economic health. These values closely align with those assigned to the three vertices of Campbell's "planner's triangle" (environmental protection, social equity, and economic development), which Campbell believes must be negotiated and balanced to achieve sustainable planning.[53] The primary difference in Campbell's definition is that he views the human component of sustainability only in terms of social justice, economic opportunity, and income equality.[54] He does not specifically mention the planner's responsibility to consider his or her powerful ability to influence physical and mental health. In this respect, Peterson's broad use of the term "health" more closely matches the definition I will be relying upon in my investigation.

These three areas of interaction (environment, economy, and equity) have been more generally adopted by the sustainability movement and are commonly referred to as

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[52] Peterson, "A Comparative Analysis of Sustainable Community Frameworks," 4.

[53] Scott Campbell, "Green Cities, Growing Cities, Just Cities?: Urban Planning and the Contradictions of Sustainable Development," *Journal of the American Planning Association* 62, no. 3 (Summer 1996): 296–312.

[54] Ibid., 298.

the "Three Es."[55] They can be traced back to the Brundtland report, *Our Common Future*, published in 1987, as a culmination of The World Commission on Environment and Development.[56]

In his book, *The Sustainability Revolution: Portrait of a Paradigm Shift*, Edwards uses the term "the three Es plus one" to include the added element of education. He states that:

> through education we gain knowledge with which to overcome the cognitive and normative – and hence emotional – obstacles to understanding our global dilemma. Through education, sustainability can become firmly established within the existing value structure of societies while simultaneously helping that value structure evolve toward a more viable long-term approach to systemic global problems.[57]

Though Edwards speaks about sustainability in general terms, his idea regarding the transformative power of education in the sustainability revolution applies equally to the sustainability of coding frameworks. Much like Edwards believes that education can evolve and shape societal values, I believe that transparently integrating education into our societal codes will provide citizens with a means of evaluating the degree to which the codes are continuing to transform their society in the manner that was originally intended and the knowledge to ensure that their codes are able to quickly respond to and support their evolving value structure.

My analysis of neighborhood-scale sustainability codes in future chapters will focus specifically on the degree to which these codes intend to and have the ability to

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[55] Andres R. Edwards, *The Sustainability Revolution: Portrait of a Paradigm Shift* (Gabriola Island, BC, Canada: New Society Publishers, 2005), 20–23.

[56] The World Commission on Environment and Development, *Our Common Future* (Oxford; New York: Oxford University Press, 1987).

[57] Edwards, *The Sustainability Revolution*, 23.

impact the environmental and human arenas of sustainability. It will also address the degree to which education is incorporated into the codes themselves.

Framework Scale

In his ICLEI USA report, Peterson identifies four general scales at which sustainable community frameworks operate: the product, commodity, building, and organization scales.[58] I have come across two additional framework scales not mentioned by Peterson, which I will refer to as the neighborhood and inhabitant scales.

Construction Frameworks

In a *product* framework, standards are developed for a single product or service, such as interior paint or cleaning services. In a *commodity* framework, the entire supply chain of a particular commodity, such as wood, is regulated, including harvesting, manufacturing, distribution, and end use. In a *building* framework, such as the LEED rating systems, an entire building is regulated, including the construction process, material use, and operations and maintenance. A *neighborhood* framework is similar to a building framework, except that, in encompassing an entire neighborhood, it must also focus on issues regarding the connections between buildings and the overall interaction and distribution of different building types and land uses throughout the neighborhood. Both LEED-ND and the HDMT, which I focus on in this study, are examples of neighborhood frameworks.

The four framework scales discussed thus far focus primarily on product specifications, building design, and development patterns and will be collectively referred to as the *construction* frameworks. The remaining inhabitant and organization scales are respectively smaller and larger than the construction frameworks. These two frameworks

[58] Peterson, "A Comparative Analysis of Sustainable Community Frameworks," 6–7.

attempt to evaluate both the individuals who will end up inhabiting the buildings regulated by the construction frameworks and the larger organizations responsible for developing, implementing, and regulating the construction frameworks in the first place.

Inhabitant Framework

The smallest scale is the *inhabitant* framework, whereby the manner in which inhabitants choose to interact with their surrounding environments is evaluated. This framework scale is an important addition to the scales identified by Peterson, because the very people for whom the buildings are being designed and who will be regulating how the buildings function for decades to come are often left out of the decision processes that establish the codes that regulate the design and construction of those buildings. While citizens may choose where to live and work and may have the ability to opt in or out of following a particular code at the time of construction or renovation, they usually have very little say about the requirements outlined in the code itself.

Because the impacts of the construction of a building can be minimal compared to the cumulative impacts of the inhabitants who regulate its use, there is a need for sustainable frameworks at the inhabitant scale. Over the thirty-year life cycle of an office building, it has been estimated that operation and maintenance (including utility costs) account for six percent of the overall building costs, while initial construction accounts for only two percent.[59] (The remaining ninety-two percent includes all personnel costs.) As a more specific example, the U.S. Department of Energy estimates that residents could reduce energy consumption by approximately five percent for each degree

[59] Joseph J. Romm, *Lean and Clean Management: How to Boost Profits and Productivity by Reducing Pollution* (New York, NY: Kodansha America, Inc., 1994), 94.

Fahrenheit they lower their thermostat during the winter.[60,61] Assuming even a fraction of residents set back their thermostats by several degrees for several decades, the cumulative impact upon total energy use would become quite significant.

In addition to controlling day-to-day behaviors that impact resource consumption, occupants and managers of buildings are also responsible for implementing technological advances and promoting cultural changes based on increased societal knowledge. For example, energy-efficient appliances and lighting, and low-flow plumbing and irrigation systems all allow buildings constructed decades ago to take advantage of newer technology to meet today's standards, but widespread implementation of these newer technologies requires a conscious decision by building owners to invest in them, since most outdated building technologies are not required to be upgraded by law unless renovations take place. Therefore, the inhabitant is the most crucial factor in determining whether a building takes advantage of our constantly evolving knowledge, technologies, and values, or whether it continues to adhere to outdated codes.

One example of an inhabitant framework is a phenomenon that has caught on in several college campuses across the country to allow on-campus students to receive a sustainability rating or certification for their individual dorm rooms based on their habits regarding electricity and water consumption and waste disposal.[62,63,64,65] Another example

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[60] U.S. Department of Energy, "Thermostats and Control Systems," *Energy Savers*, February 9, 2011, http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12720.

[61] U.S. Energy Information Administration, "Winter Energy Savings from Lower Thermostat Settings," *U.S. Energy Information Administration - EIA - Independent Statistics and Analysis*, December 12, 2000, http://www.eia.doe.gov/emeu/consumptionbriefs/recs/thermostat_settings/thermostat.html.

[62] Rice Environmental Club, "Green Dorm Initiative," *Rice Environmental Club*, n.d., http://enviclub.rice.edu/green-dorm-initiative/.

[63] Jocelyn Wright, "Green Dorm Initiative Launches Campuswide," *The Rice Thresher*, April 9, 2010, sec. News, http://media.www.ricethresher.org/media/storage/paper1290/news/2010/04/09/News/Green.Dorm.Initiative.Launches.Campuswide-3902555.shtml.

is the National Wildlife Federation's Certified Wildlife Habitat program, which allows individuals to certify the outdoor portions of their homes for providing essential elements of a wildlife habitat, such as food, water, and shelter.[66]

Organization Framework

At the opposite end of the spectrum is the *organization* framework, whereby the performance of entire corporations, governments, and non-governmental organizations is evaluated. Because these entities are often developing, implementing, and enforcing the construction frameworks that go on to regulate nearly everything in our built environment, the organization frameworks have a powerful ability to influence community sustainability. The previously mentioned STAR Community Index, developed by ICLEI USA, is an example of an organization framework.

Scale	**Subject of evaluation**
Product	A single product or service
Commodity	The entire supply chain of a commodity
Building	The construction, material use, operation, and maintenance of a building
Neighborhood	The buildings, transportation networks, and land use distribution within a neighborhood
Inhabitant	The behavioral interactions of an individual inhabitant with their environment
Organization	A corporation, government, or non-governmental organization

Table 3: Summary of Framework Scales

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[64] "Greening Your Dorm Room" (Green Pages, St. Lawrence University, 2009), http://www.stlawu.edu/green/sites/stlawu.edu.green/files/DormAudit.pdf.

[65] Campus Sustainability Initiative, "Certified Green Room," *Campus Sustainability Initiative, Brandeis University*, n.d., http://www.brandeis.edu/campussustainability/getinvolved/greenroom.html.

[66] National Wildlife Federation, "Register Your Yard as a Certified Wildlife Habitat," *National Wildlife Federation*, 2010, http://www.nwf.org/gardenforwildlife/certify.cfm.

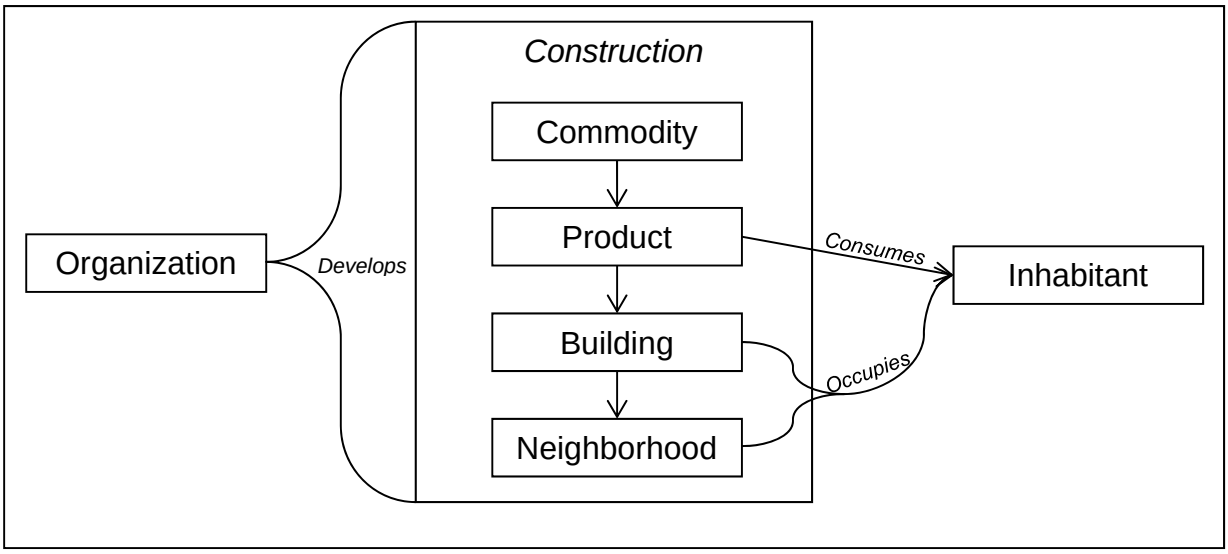

Figure 1: Hierarchy of Framework Scales

Multi-Scale Framework Integration

Based on the six framework scales that have been outlined, it seems impractical, if not impossible, for a single framework to encompass sustainability at every scale. Instead, sustainable coding would likely benefit from a system of multiple frameworks which support and rely upon each other to provide specifications at each scale in each subject area. In order for such a multi-scale system to be implemented effectively, there would need to be a tremendous amount of collaboration between the various organizations developing the frameworks.

USGBC has been exceptionally successful at integrating its LEED frameworks with numerous other frameworks of different scales. Since the LEED rating systems focus on sustainability at the building and neighborhood scales, they rely on other frameworks to establish standards at the product, commodity, and organization scales, when possible. For example, LEED-NC awards credits for adhering to Green Seal standards for paints at the product level and for using wood products with Forest

Stewardship Council Chain of Custody certification at the commodity scale.[67] USGBC has also been successful at encouraging localities to require compliance with their standards to integrate at the organization scale. As of December 2011, LEED standards have been integrated in some form into the policies of 442 localities in 45 states, 34 state governments, 14 federal agencies and departments, 16 public school jurisdictions, and 39 institutions of higher education, thereby tying LEED into an impressive number of organization frameworks.[68,69] Also impressive is how rapidly this integration is taking place. A year earlier, in August 2010, LEED policies were implemented in 243 localities, and in only 198 localities a year before that in June 2009.[70,71]

The success of LEED is undoubtedly due to its demonstrated ability to integrate well with other existing frameworks at both smaller and larger scales. I believe that a comprehensive program of sustainability will require this type of integration of multiple framework scales, in addition to the integration of frameworks covering diverse topic areas. It is also interesting that the rapid development of LEED did not occur within existing government frameworks, but, rather, as a collaborative process spearheaded by a non-profit less than twenty years old as of this writing. Because embracing sustainability often requires completely reframing existing processes, it is likely faster to do so through

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[67] U.S. Green Building Council, *LEED for New Construction Version 2.2 Reference Guide*, Third ed. (Washington, DC: U.S. Green Building Council, 2007), 287, 343.

[68] U.S. Green Building Council, "Public Policies Adopting or Referencing LEED," *USGBC: U.S. Green Building Council*, December 20, 2011, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1852.

[69] Association for the Advancement of Sustainability in Higher Education, "Campus Building Guidelines and Green Building Policies," *Association for the Advancement of Sustainability in Higher Education*, 2012, http://www.aashe.org/resources/campus-building-guidelines-and-green-building-policies.

[70] U.S. Green Building Council, "LEED Public Policies," *U.S. Green Building Council*, August 20, 2010, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1852.

[71] U.S. Green Building Council, "LEED Public Policies," *U.S. Green Building Council*, June 2009, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1852.

new unregulated organizations whose resulting codes can be wholly adopted after they are tested and established, rather than reworking existing regulations from the ground up through traditional government frameworks.

Contested Multi-Scale Framework Integration

It should be noted that integrating frameworks of different levels can be a highly contested process, as some frameworks inevitably get selected for inclusion, while others do not. One example is the fight for inclusion of commodity-scale frameworks regulating wood in all of the LEED building-scale rating systems. From the time of inception, the Forest Stewardship Council (FSC) certification has been the only sustainable forestry framework accepted to earn LEED credits. A competing framework, the Sustainable Forestry Initiative (SFI), which was developed largely by the U.S. forestry industry, has been fighting for inclusion over recent years. In a series of four drafts from 2008 to 2010, USGBC aimed to develop Forest Certification Benchmarks, which would create criteria for evaluating sustainable forestry frameworks for inclusion into LEED rating systems. The benchmarks were ultimately rejected by a vote at the end of 2010, even by the SFI, effectively shutting out competing frameworks from LEED for the time being.[72,73,74,75]

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[72] "USGBC: Forest Certification Benchmark Ballot Outcome", December 6, 2010, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=2378.

[73] Sustainable Forestry Initiative, "SFI's Statement on the USGBC's Fourth Draft Forest Certification Benchmarks," *Sustainable Forestry Initiative*, June 15, 2010, http://www.sfiprogram.org/newsroom/?p=377.

[74] Sustainable Forestry Initiative, "SFI's Statement on the USGBC's Forest Certification Benchmark Vote", November 2, 2010, http://www.sfiprogram.org/files/pdf/SFI%20USGBC%20Statement%20Nov%202010.pdf.

[75] "FSC remains only forest certification system to qualify under the USGBC's LEED MRc7 credit for certified wood," *Forest Stewardship Council*, December 13, 2010, http://www.fsc.org/news.html?&no_cache=1&tx_ttnews%5Btt_news%5D=1409&cHash=adb13fd80e.

As of 2012, the SFI has an entire portion of their website devoted to petitioning USGBC for inclusion in the LEED rating systems, featuring letters from over 100 U.S. governors and congressmen and an online public petition with over 6,000 signatures.[76,77] In their last statement on the issue, the SFI urged the building community to "forgo the one point in the certified wood credit and use SFI-certified products in LEED buildings to demonstrate their pride and support for North American forests, communities, and jobs."[78]

Another example of contested frameworks is the selection of building-scale frameworks for inclusion in organization-scale frameworks in Austin, Texas.[79,80,81] In addition to the national LEED rating systems, there is a locally developed and implemented rating system administered by the local utility company called the Austin Energy Green Building (AEGB) program which takes local conditions in Austin into account. The AEGB program predates both the USBGC and the LEED rating systems by seven years and was even used as an early model in the development of LEED.

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[76] Sustainable Forestry Initiative, "LEED Key Voices," *Sustainable Forestry Initiative*, n.d., http://www.sfiprogram.org/leed/leed_key_voices.php.

[77] "LEED - Sustainable Forestry Initiative", n.d., http://www.sfiprogram.org/leed/leed_recognized.php.

[78] Sustainable Forestry Initiative, "SFI Inc. Committed to Work with the Building Community to Support Responsible Forestry in Green Building", December 6, 2010, http://www.sfiprogram.org/files/pdf/statement_usgbc_dec62010.pdf.

[79] Nadia Macias, "Austin LEEDS the Way," *The Horn*, April 6, 2011, http://www.readthehorn.com/local/3957/austin_leeds_the_way.

[80] Kelsey Wilkinson, "Green Building Standards Present Challenges, Choices for City," *Community Impact Newspaper*, January 29, 2010, http://impactnews.com/northwest-austin/239-local-news/6808-green-building-standards-present-challenges-and-choices-for-city.

[81] Mary Tuma, "Nation Follows Austin's LEED," *Community Impact Newspaper*, January 15, 2010, http://impactnews.com/central-austin/news/6609-nation-follows-austins-leed.

In 2000, the Austin City Council passed a resolution mandating that all new municipal buildings earn LEED Silver certification.[82] This mandate was updated with another resolution in 2007 to also require LEED Silver certification for major renovations and additions over $2,000,000 requiring work in all five major LEED rating categories and smaller renovations over $300,000 requiring work in three major LEED rating categories, and to develop Baseline Sustainability Standards for all projects not meeting the above criteria.[83]

In contrast, predominately between 2003 and 2007, an increasing number of ordinances were passed requiring particular AEGB ratings. Currently, all buildings zoned Central Business District or Downtown Mixed Use,[84] all single-family residential buildings in Traditional Neighborhood Districts,[85] all multifamily residential buildings zoned University Neighborhood Overlay,[86] and all S.M.A.R.T. Housing program buildings[87] must achieve a one-star AEGB rating. In addition, all projects in the Wildhorse, Comanche Canyon, and Pioneer Cross Planned Unit Developments (PUDs), require a one-star AEGB rating, while those in the East Avenue, Lakeshore, and Domain PUDs require a two-star rating.[88] In 2007, a resolution was passed to develop assistance,

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[82] Austin, Texas, *Resolution No. 000608-43*, 2000.

[83] Austin, Texas, *Resolution No. 20071129-045*, 2007.

[84] Austin, Texas, *Ordinance No. 030612-93*, 2003.

[85] Austin, Texas, *Ordinance No. 970717-E*, 1997.

[86] Austin, Texas, *Ordinance No. 040902-58*, 2004.

[87] Austin, Texas, *Ordinance No. 20071129-100*, 2007.

[88] "Projects Requiring an Austin Energy Green Building Rating", 2012, http://www.austinenergy.com/Energy%20Efficiency/Programs/Green%20Building/Participation/requirements.htm.

incentives, and policies in support of achieving upper-tier AEGB ratings where green building is already mandated by city programs.[89]

Though most Austin codes mandate the use of a particular rating system, some newer codes allow developers to select which rating system they wish to pursue. One example is the Mueller development, where single-family and duplex homes require a three-star AEGB rating, but multifamily homes, along with office, single-tenant retail, and institutional buildings greater than 25,000 square feet have the option of achieving a two-star AEGB rating or a LEED Certified rating.[90]

It appears that Austin has selected LEED as the exclusive building-scale framework for municipal buildings and that it has also heavily relied upon LEED for commercial and institutional buildings. Because LEED is a nationally recognized program, and because Austin prides itself on being one of the most progressively sustainable cities in the nation, there is undoubtedly pressure to follow national conventions for municipal buildings. While AEGB ratings may be equivalent or superior to LEED for Austin's particular climate and culture, they do not have equivalencies in other cities and, therefore, do not confer the same prestige that can be easily measured and recognized uniformly throughout the nation.

On the other hand, Austin has almost exclusively selected the AEGB program as the building-level framework for residential buildings. I would argue that, because AEGB is developed locally, it can be more easily and quickly adapted as local knowledge and values change, along with changes in local climate and material availability. It is the opposite of a code, such as LEED, that is adapted across a wide variety of climates,

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[89] Austin, Texas, *Resolution No. 20070215-023*, 2007.

[90] Travis County, Texas, *Document No. 2005193821 Mueller Design Book*, 2005, 118.

economic conditions, and cultural norms, thereby making it more sustainable, according to my definition as stated at the beginning of this chapter. Because the cumulative impact of all housing far outweighs the impact of a relatively small number of municipal buildings, it is logical from the perspective of sustainability to build housing according to locally created and targeted standards.

As illustrated with these two examples, the issue of competing frameworks can complicate the process of integrating multiple framework scales into one comprehensive framework; especially in the case of the forestry standards, where USGBC ended up developing a framework for evaluating forestry frameworks for inclusion into their own building frameworks. Despite these complications, this process of contestation also engenders continuing discussion and evaluation of the codes as they stand, which I am arguing is ultimately necessary for codes to remain sustainable. A code that has reached universal acceptance could too easily stagnate, as it is disagreement that so frequently provides the impetus for reevaluation and change.

Framework Type

In addition to framework scales, Peterson also identifies four major types of sustainable community frameworks: ranking projects, designation systems, indicator initiatives, and sustainability programs.[91] Ranking projects rely upon metrics to evaluate and score entities and then rank them in order of performance. Designation systems offer some combination of voluntary and/or mandatory credits that may be pursued by entities wishing to earn a particular designation from a certifying body. LEED-ND is an example of a designation system. Indicator initiatives are longitudinal measures of quantitative and qualitative information about an entity's performance and show movement towards or

[91] Peterson, "A Comparative Analysis of Sustainable Community Frameworks," 21–22.

away from particular goals. The HDMT is an example of an indicator initiative. Finally, sustainability programs are internally developed by entities to package and brand their sustainability plans and initiatives.

Type	**Measures**
Ranking projects	Rank entities based on metrics
Designation systems	Designate achievement levels based on earning credits
Indicator initiatives	Measure quantitative and qualitative longitudinal information
Sustainability programs	Package and brand internal sustainability plans

Table 4: Summary of Framework Types

Though Peterson does not specifically link them, it appears from his work that particular framework types lend themselves to particular framework scales. Ranking projects are most often used to rank cities or countries and, therefore, deal largely with the organization scale. Designation systems have very specific requirements and are commonly implemented at the neighborhood, building, and product scales, though they could conceivably be used at any scale. Since indicator initiatives tend to focus on change over time, they require a large enough area of study that change will be observable and significant within a relevant time period. Therefore, the neighborhood scale is probably the smallest appropriate scale for indicator initiatives, though they seem to be used most commonly at the organization scale. Finally, because sustainability programs are meant to create structure and vision for a particular entity by their very definition, they are always implemented at the organization scale.

In addition to varying mechanisms and scales, each of the four framework types serves a different purpose and has a different potential to be used in creating a sustainable code. Ranking projects put the current state of affairs in perspective and illuminate which

entities rank higher than others and what strategies they used to receive this higher ranking. In highlighting differences and bringing short-comings to light, they can serve as motivation for entities that received poor rankings to do better in the future and as positive affirmation to those entities that received high rankings, but, unfortunately, ranking projects aren't inherently action-oriented (other than in the competition they foster) and, in that respect, they serve as more of a research or reporting tool than a mechanism for effecting sustainable change.

Designation systems are usually targeted towards shaping major industries, and, because they dictate very specific requirements or outcomes, they can be very effective at promoting change; however, they are only as sustainable as the particular designation system is adaptable to advances in our knowledge and technologies. A rigid designation system that is difficult to change may seem better for environmental and/or human health in the short term, but, ultimately, will not be truly sustainable in the long term according to my definition.

Because indicator initiatives provide both the evaluation component of ranking projects and the action-oriented goals of designation systems, they have great potential for being a sustainable framework type, but only if they are innately tied to planning and implementation processes. In other words, it is not enough to set a goal and then arbitrarily evaluate whether or not that goal has been achieved years down the road. There must be mechanisms in place to assure that steady progress is made towards the goal and to periodically reevaluate whether or not the goal is still the best way to uphold society's present values.

Interestingly, all of the framework types, except for sustainability programs, involve evaluating or rating either the current state of affairs or projects which have already been completed. In order to move towards more sustainable practices, significant

amounts of planning and action will be required. In that respect, it seems that any ranking project, designation system, or indicator initiative should be carried out as just one part of a comprehensive sustainability program, rather than as a stand-alone sustainability solution. Much like with framework scales, sustainable community frameworks will be most effective when they also cohesively integrate multiple framework types.

Sustainable Neighborhood Codes

For clarification of terminology, we can now see that the *sustainable codes* and *metrics* that I will analyze in future chapters are a subset of Peterson's *sustainable community frameworks*. The very nature of a code is to recommend or mandate particular methods or outcomes, which can certainly be compared and evaluated, but intend primarily to promote change or ensure maintenance of the status quo. Code compliance typically requires active involvement of the project team and the code creators, evaluators, and enforcers. Other sustainable community frameworks that are not codes can be geared strictly towards observation and measurement, either to establish a baseline of current conditions or to evaluate a project or entity based on past or current actions. Theoretically, these other types of frameworks could be implemented by outside parties that have little to no influence on the outcome of the project or the actions of the members of the organization being evaluated. In that respect, those frameworks types are more research-oriented than action-oriented.

MEASUREMENT AND ENFORCEMENT OF BUILT ENVIRONMENT CODES

Different sustainability movements tend to rely on particular types of codes to transform society. Two categories of codes particularly relevant to the environmental and public health movements are economic codes and civil codes. While the ecological modernization movement lends itself to economic codes, both the environmental justice

and public health movements focus more upon civil codes. Both economic and civil codes will be discussed in greater detail below, including variations within the two categories of codes and their respective strengths and weaknesses. The code typologies that I explore in this section were first presented to me by Dr. Steven Moore in the *Building Codes and the Environment* graduate seminar at The University of Texas at Austin in the Fall of 2008 and were later published by Moore and Wilson in 2009.[92]

Economic Codes

Economic codes are those that increase the exchange value of particular commodities through standardization or enforcement of societal values. They are a tool commonly used by the ecological modernization movement, because the movement seeks to demonstrate that operating in a manner that is beneficial to the environment can be simultaneously beneficial to the economy. The more that sustainability becomes codified, the more it will be of economic benefit, because successful codification will cause the demand for sustainable design to increase, both within industry and by the general public.

Methods for both measuring and enforcing compliance with economic codes can vary greatly. Moore and Wilson identified three distinct strategies whereby economic codes can be used to enforce social values: prescriptive, incentive, and performance.[93] I, however, view the measurement and enforcement of code compliance within a framework consisting of two intersecting sliding scales, as shown in Figure 2 on the following page. Code compliance can be measured using prescriptive and/or performance requirements, while code enforcement can be carried out through a combination of

[92] Steven A. Moore and Barbara Brown Wilson, "Contested Construction of Green Building Codes in North America: The Case of The Alley-Flat Initiative," *Urban Studies* 42, no. 12 (November 2009): 2617–2641.

[93] Ibid., 2624.

incentives and/or disincentives. The method of implementing a particular code can fall anywhere within the two-dimensional space created by the intersection of these two scales.

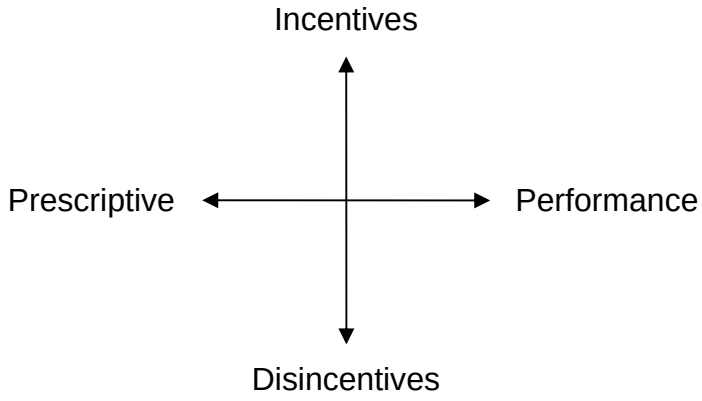

Figure 2: Economic Code Classification Framework

Prescriptive Measurement

Prescriptive requirements dictate the use of precise materials and methods, which have been demonstrated to reliably achieve a particular goal. Unfortunately, the emphasis of many prescriptive codes becomes controlling the particular method of achieving this outcome, rather than ensuring the outcome itself is achieved. While mandatory prescriptive codes can be effective at rapidly changing the quality of the built environment, the widespread uniform application of such codes fails to account for local variations and often results in unintended or undesirable results. The potential hazards of codifying methods without simultaneously expressing desired goals will now be discussed.

Section 25-2-779 of the Austin City Code dictates requirements for small lot single-family residential use, including a maximum structure height of 35 feet, a minimum front yard setback of 15 feet, and a maximum building coverage of 55 percent

of the lot.[94] Amongst these requirements, there is no mention of the overarching goal of these restrictions, how it is expected that these particular restrictions will ensure that the goal is achieved, or how the precise thresholds were determined. While one would assume that such specific requirements were implemented for a particular reason, it is impossible to decipher this reason directly from the code itself.

Those with sufficient knowledge of neighborhood design may recognize that these particular requirements are likely related to preserving character, open space, and access to light and minimizing stormwater runoff, but even such knowledge does not help to decipher why those particular thresholds were selected. Because such thresholds can vary greatly between cities and even between different zoning types or special districts within the same city, there is nothing particularly intuitive about them.

In many cases, absolute standardization through coding makes sense. For example, creating uniform electrical outlets allows anyone to use any appliance in any building, which is unarguably of benefit to society. The problem with prescriptive codes when absolute uniformity is not required is that they can prevent designers from easily employing new and creative methods to exceed minimum requirements and/or conserve financial, labor, and material resources. For example, say I know that limiting my development footprint will improve the quality and quantity of stormwater runoff in my neighborhood and I am supportive of that goal, but if my ideal building that perfectly suits the needs of all occupants takes up 56 percent, rather than 55 percent of the lot, will that really have a significant effect on stormwater? Suppose I decide to set up a rainwater catchment system that collects, filters, and slowly releases 90 percent of the rain falling on the building, which I could argue would reduce stormwater runoff dramatically more

[94] Austin, Texas, *§25-2-779 Small Lot Single-Family Residential Use, Austin City Code*, 2004.

than limiting my building footprint by that extra percent. Because the purpose of the small lot single-family residential use regulations has not been elucidated, there is no way to evaluate whether or not such innovative solutions meet or exceed the intended standards. Instead, these regulations dictate a particular type of building scale, siting, and massing, which may not inherently result in the most effective way of accomplishing the desired goal, especially as our knowledge and the technologies available to us continues to improve. By restricting innovation, prescriptive codes can stifle the very creativity that will ultimately lead to greater sustainability of the built environment and, in their lack of inherent adaptability, they often are not a sustainable type of code, according to my definition at the beginning of this chapter.

There are several likely motivations behind the decision to leave the intent of a code out of the code itself. The first possible motivation is to preserve the power of the people who have created the code. Codes are commonly thought of much like indisputable truths that must simply be adhered to. Ultimately, we know if we want to get something built, we must follow the codes. By explaining the reasoning behind a code, the code suddenly becomes a manifestation of human beliefs or goals, thereby making it more apparent that there is potentially an issue up for debate. Even those who are likely to protest a code will inevitably have a more difficult time doing so when it is clear to neither the code-breaker nor the law-maker what exactly the code is trying to preserve.

A second motivation for leaving the intent out of a code is actually a lack of motivation altogether. Often when codes are first created, the reasoning behind them is quite obvious to everyone involved in their creation. In some cases, codes merely formalize what is already widely practiced by society. Because the reasoning of the code seems so obvious to the originators, they may not even realize it needs to be explained, but, years later, when society and environmental conditions have changed and other

related standards have evolved, it may not be so obvious anymore, especially if the code has been adapted outside of the place and time for which it was originally created. In addition, formally written codes are often so long and complex that both code creators and users may see any additional written explanations as unnecessary text that prevents the actual requirements from standing out. I, on the other hand, might argue that providing the reasoning behind codes might strike a deeper understanding on the part of the person implementing the code, so that its meaning becomes naturally understood, rather than having to rely upon rote memorization of standards, much as experiential learning fosters a much different type of understanding than recitation of facts.

A final reason the intent of a code is often left out is that the work of creating codes can be so tedious that municipalities frequently borrow codes, often in their entirety, from other locales. It is likely these borrowed codes do not include their intents in written form, and, even if they did, such intents may not be completely applicable to the unique conditions in which they are being adopted and would require a significant amount of reworking. When this transfer of codes happens without a full understanding of the intent of the original code and without regards to any differences in local conditions, it is easy to imagine that unintended consequences may develop.

Prescriptive codes regarding all aspects of community development are currently the norm in much of the United States. When adopted in an all-encompassing manner, many codes were extremely effective at improving public health issues present at the time of their creation. The main problem is that, as society and other conditions continued to evolve and people developed different lifestyles and priorities, the same codes continued to be used without revision. For example, Euclidian land use codes were perfectly effective at meeting the desired goal at the time of reducing public health risk due to exposure to infectious diseases and toxins, but the continued dominating pattern of

a strict separation of land uses and heavy dependence upon automobiles has contributed to another set of public health risks, this time related to chronic diseases. The problem was not with the original codes themselves, but that they were not continuously evaluated as new environmental and public health issues began to develop. While it is, in fact, still considered unacceptable to expose residents to harmful levels of toxins released by some industrial uses, it is now known that a strict separation of all land uses is not the only method of achieving this goal. Zoning trends such as planned unit developments, transit-oriented developments, mixed-used developments, and form-based codes are all attempts to reevaluate Euclidian zoning and develop new types of codes that are more appropriate for achieving present-day environmental and public health goals.

Despite these negative aspects of prescriptive codes, there are tremendous advantages to using them. They provide a clear way to get things done quickly when widespread and rapid action is required to address an urgent problem. They also allow places that may not have the manpower, time, or expertise to develop locally contextual codes to at least benefit from the experience and research of others. It should also be noted that a prescriptive code does not by its very nature have to leave out its intent. In my opinion, many of the negative aspects of prescriptive codes can be eliminated by simply including intent inside of the written code and by evaluating the code frequently to ensure that it is still meeting the intended goals and that those goals are still applicable to present society. In addition, the organizational framework must provide a relatively easy pathway for updating the codes when it is determined that changes are desirable.

Performance Measurement

An alternative to relying upon prescriptive requirements to measure compliance with economic codes is the use of performance requirements. Performance requirements

dictate a particular outcome, but do not necessarily specify the means of achieving that outcome. There are two general implementations of performance-based codes described by Hurley: "(1) as a means to determine equivalency to a prescriptive code or standard, or (2) as an approach to achieve broadly defined […] goals and objectives."[95]

The first implementation provides an alternative to conventional prescriptive codes. Perhaps, the main advantage of basing performance on equivalency codes is that they can seamlessly integrate into the existing framework of prescriptive codes. In fact, prescriptive codes are necessary to establish the baseline standard by which to measure the equivalency. Adding an equivalency statement into existing prescriptive codes would allow visionaries and innovators to introduce new concepts to a certain extent within the existing system, while simultaneously leaving prescriptions for those who do not have the resources for innovation, though the dramatic difference between these two compliance paths creates an inherent inequity in this type of code.

The main obstacle to the successful implementation of equivalency codes is the very issue discussed previously that the intent behind the prescriptive codes on which they would need to be based is often missing. Foliente emphasizes this point, saying that a "prescriptive solution would 'imply' a certain level of performance, but this is not explicitly or quantitatively stated. Thus it would take a tremendous amount of work to demonstrate that another solution […] would equal this unspecified performance level. In contrast, a performance-based code would have a clear and quantified description of required performance."[96] Without a complete understanding of the desired outcome upon which to base the measure of equivalency, it becomes impossible to determine whether

[95] Morgan J. Hurley, "The Practice of Performance-Based Design," *Fire Protection Engineering* 29, no. 1 (Winter 2006): 2.

[96] Greg C. Foliente, "Developments in Performance-Based Building Codes and Standards," *Forest Products Journal* 50, no. 7/8 (August 2000): 12–21.

two things should indeed be considered equivalent. Another problem with equivalency codes, even if the intents of their respective prescriptive codes are clear, is that they require enforcement by people who are sufficiently educated to properly assess the predicted outcome of creative solutions, rather than reject them simply as being different from the original prescriptive codes.

The second type of implementation of performance-based codes described by Hurley involves the use of codes to implement an overall vision. With regards to fire protection engineering, he believes that the profession must strive to implement these visionary performance-based codes to rise in stature.[97] I believe the same thing is largely true for society as a whole, because once codes become static, the ability to contribute new knowledge to society through building ceases. An additional benefit of performance-based codes is that requiring designers to prove their designs fulfill a certain vision would require them to prove knowledge of the situated context, rather than allowing them to simply copy a solution that may or may not be best for the particular community involved.

The particular combination of prescriptive and performance requirements within a code determines the degree to which designers have both creative freedom and an obligation to justify their design, as described by Foliente.[98]

Incentive Code Enforcement

In addition to variations in the way economic code compliance is measured, there are differences in the way economic code compliance is enforced. Enforcement of codes can be applied through any combination of incentives and disincentives. Mandated codes

[97] Hurley, "The Practice of Performance-Based Design."

[98] Foliente, "Developments in Performance-Based Building Codes and Standards."

are those which must be complied with and are typically associated with a strong penalty for their avoidance. In contrast, incentive-based codes are those which incentivize, rather than require, certain outcomes. The primary weakness of incentive-based codes is that, by their very nature, compliance is not required. Lee Einsweiler, a principle at Code Studio and adjunct professor at The University of Texas at Austin, has described the ramifications of this weakness. He believes that if a community has taken the time to establish a particular vision, then they should not leave it up to developers to decide whether or not to carry out this vision.[99] While incentives may steer developers in the right direction, they still allow plenty of room for developers to stray from the vision trying to be achieved.

Another disadvantage of incentive-based codes is that they require sufficient resources. If the incentive is monetary, then funding must be obtained, or if the incentive is an expedited review process, then sufficient manpower is required and other projects in the queue may be sacrificed at their expense. In many cases, the incentive allows developers to break other city-wide requirements in order to achieve a particular neighborhood goal. For example, a developer may be able to build at a greater density than allowed by code if they agree to dedicate a certain amount of open space and provide funding for the development of hike and bike trails. In such a case, one component of the vision is essentially being sacrificed for another.

Though incentive-based codes may not be an assured and immediate means of implementing a vision, I do believe they can be an effective transitory tool. The process of adopting new codes is a highly contested process which often puts public and private interests at odds with each other. Incentive-based codes provide a strategy for

[99] Lee Einsweiler, "Legislation and Form-Based Codes", October 9, 2008.

encouraging the private sector to develop in a manner consistent with public goals and, because they are rewarded for compliance, rather than penalized for avoidance, adoption of such codes is more likely to be accepted by all parties. Sometimes it is difficult to adopt new codes, simply because their intentions reflect emerging values, rather than widely established and accepted values. Effective financial incentives that encourage numerous private parties to implement new practices thereby help make the practices and their embedded values more commonplace. Once the practices become widely accepted, it would likely become easier to adopt mandated versions of the same codes.

An added advantage of incentive-based codes is they can connect related costs and benefits that may not otherwise factor into the cost-benefit analysis for the same party. For example, a cost-benefit analysis of the installation of residential solar panels may show that an investment is easily paid off in reduced electricity bills over the first seven years. Unfortunately, many homeowners do not have sufficient capital to make the initial investment and the builders who do have the capital would not receive the pay off, since they are not responsible for electricity costs over the lifetime of the home. Incentives in the 2005 revision to the Energy Policy Act have helped to overcome this disconnect between those responsible for creating environments and those who are ultimately affected by them by provided federal tax credits to builders constructing Energy Star rated homes, who might otherwise have little financial incentive to do so.[100]

Civil Codes

Civil codes arise out of a very different origin than economic codes. They reflect publically shared beliefs, habits, and values regarding the development and use of space. The making of civil codes requires a conscious decision to reframe a dilemma in light of

[100] Charles W. Schmidt, "Room to Grow: Incentives Boost Energy-Efficient Homebuilding," *Environmental Health Perspectives* 116, no. 1 (January 2008): A34.

developing values. Civil codes revolve largely around the issue of rights. In some cases, the discussion of these rights relates only to a particular subset of the population in the context of the rights of the larger population. For example, in the United States, civil codes have established the rights of women, children, minorities, and the disabled to make use of particular spaces. In other cases, the discussion of rights pertains to the health and safety of society as a whole. Some of the earliest zoning laws in the United States were related to protecting public health.[101] Industries and governments later began to develop codes to protect the public from unnecessary accidents that endangered the health and safety of society. As a result, society began to value life to the point where preventable accidents and the uncontrolled spread of disease would no longer be tolerated.

Current discussions about the relationship between the built environment and public health revolve around chronic diseases, such as asthma, cardiovascular disease, diabetes, and obesity. I believe the next major revolution in civil codes will relate to these issues. Though particular segments of the population are more vulnerable to chronic disease and exposure to environmental hazards, as demonstrated by the environmental justice movement, I believe the issue of chronic disease is something to which everyone can relate and to which no one is immune, thereby making it a unifying issue around which it is possible to develop transformative civil codes.

In order for this revolution to take place, we will first need to overcome traditional methods of evaluating the benefits of public health. Campbell defined sustainable planning as negotiating a balance between economic development,

[101] Wendy Collins Perdue, Lesley A. Stone, and Lawrence O. Gostin, "The Built Environment and Its Relationship to the Public's Health: The Legal Framework," *American Journal of Public Health* 93, no. 3 (September 2003): 1392.

environmental protection, and social equity.[102] However, Feenberg discusses how much of today's environmental discourse is still based on the concept of trade-offs, whereby environmental quality must come at the expense of the economy and social equity is not factored in at all.[103] The same trade-off theory is also used frequently in public health discourse, whereby changing the built environment in ways proven to improve health would necessarily bear an impractical cost on industry and, ultimately, harm the economy.

There are at least four possible alternatives to relying exclusively upon simplistic trade-offs to shape progress. First, Feenberg illustrates how trade-off theory fails to recognize the possibility of developing alternative technologies that do not require a sacrifice at all. In other words, it is often possible to improve environmental quality or public health while simultaneously boosting the economy. These technological fixes often serve as a first line of defense and may not even relate to civil codes. Secondly, even when basic trade-off theory is upheld using cost-benefit analysis, the economic incentive-based codes, as previously discussed, can be adopted to tip the balance in favor of a particular idealistic value that is embraced by society, but that is not yet sufficiently valued monetarily. A third option is to better incorporate social equity into any sort of trade-off analysis that is performed from the start. The major problem with this proposal is that placing monetary values on equity is incredibly subjective and such an analysis is likely to favor whichever party has the greatest control over the process. As an alternative to a pure economic analysis, Moore and Wilson argue that "civil codes…are best at

[102] Campbell, "Green Cities, Growing Cities, Just Cities?".

[103] Feenberg, "Incommensurable Paradigms: Values and the Environment."

incorporating social equity as a criterion for action and public assessment."[104] Finally, Feenberg discusses a fourth phenomenon, whereby it is possible to shift the boundaries of the economy to the point where the trade-off ceases to be an economic issue. One role of civil codes is precisely to shift these economic boundaries to the point where a trade-off would no longer even be considered in the case of something highly valued by society.

To appeal to a capitalistic society, whereby economic trade-offs still seem like a promising way to communicate with the masses, several studies have attempted to calculate the costs of chronic diseases to society. The Centers for Disease Control and Prevention calculated that the direct medical expenses alone associated with physical inactivity amounted to more than $76 billion in 2000.[105] Another study cited by Feenberg values the cost of each asthma attack at $32.[106] Who pays these costs and how might the opposing costs of remediating recognized problems with our current development patterns be justified?

Individuals and health care providers bear not only the burden of these direct medical costs, but also of the consequences of a lower quality of life and a shorter life expectancy. Many of the same studies that assign societal costs to poor health argue that a large part of the solution lies in the basic ways that we construct the built environment, but, unfortunately, the individuals that would receive both economic and social benefits from reducing health burdens are not the ones who are investing in the built environment. A large portion of the costs related to the shaping of our built environment are paid by

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[104] Moore and Wilson, "Contested Construction of Green Building Codes in North America: The Case of The Alley-Flat Initiative."

[105] Transportation Research Board, *Does the Built Environment Influence Physical Activity? Examining the Evidence*, TRB Special Report (Washington, DC: National Academy of Sciences, 2005).

[106] Feenberg, "Incommensurable Paradigms: Values and the Environment," 284.

private developers. Therefore, those who are shaping our communities are not the ones who later have to pay for the chronic diseases associated with residing in them.

This situation represents a severe limitation to cost-benefit analysis, in that the costs and benefits are not applicable to the same parties and, thereby, using them to calculate efficiency in a universal equation is merely a hypothetical and simplistic exercise. In reality, health burdens are simply externalized costs to developers and community development is an externalized cost to healthcare providers. One radical solution to this disconnect might be to reframe the costs and benefits into the same system by requiring developers to provide health insurance for the residents of their communities. While I believe such a solution would adequately incentivize developers to embrace our societal value of health, it is obviously far from realistic widespread implementation, but the concept is not beyond reason. Employer-provided health insurance is quite common in the United States and employer-provided housing is not unheard of, especially for occupations in remote locations. Combining the two provides a realistic example that is within our realm of experience. To take it to a larger scale, every level of government in the United States pays for at least a portion of healthcare for a subset of the population, along with many aspects of the built environment, including housing and transportation.

Due to the complexities involved with reframing and rebalancing externalized costs, a more likely approach would be for society to develop new civil codes whereby prevention of chronic disease is so highly valued that it rises in importance above the realm of the economy. Doing so will not only require creating new civil codes, but also analyzing and publicly discussing the intent behind existing codes and evaluating the extent to which they can be upheld based on society's newly developed values or whether they must be redefined in this new light.

SUSTAINABLE CODE ELEMENTS

The following is a list of elements that I believe are crucial to the development of a sustainable neighborhood code. The selected elements and my definitions of the elements are based largely on my observations and explorations of what is present and missing in numerous codes, including LEED-ND, the HDMT, and various City of Austin Neighborhood Plans. While the elements are likely to be useful for any number of other types of codes, they have not been developed with other uses in mind.

Vision

The vision should establish a broad idea of the desired future for the neighborhood and the overall purpose of the code. It should be inspirational and optimistic and may transcend the concept of feasibility. It should also be general enough so as to serve as a unifying force that can be agreed upon by the community. An example vision related to environmental health might be to preserve the diversity and habitat of native plant and animal life. An example vision related to human health might be to support and improve the physical, mental, and social health of all residents.

Goal

A goal establishes a measurable outcome in support of a specific component of the vision. Unlike the vision, the goal should be specific as to the particular outcome desired, though the specific means of accomplishing the goal may not appear in this section. An example goal related to environmental health might be to reduce natural resource consumption and air and water pollution by decreasing the per capita energy consumption of local residents. An example goal related to human health might be to reduce the incidence of obesity within the neighborhood by encouraging physical activity and promoting healthy nutrition.

Action

Actions are specific and feasible steps that can be taken to achieve each goal. Actions are a necessary part of a sustainable neighborhood code, because they transform documented desires into real physical changes. When we think of traditional building codes, we think primarily of the action components, which dictate the particular materials and methods to use or the specific outcomes which must be achieved. An example action related to energy use might be to provide financial incentives for the installation of onsite renewable energy systems within the neighborhood. An example action related to reducing obesity might be to increase the miles of trails within the neighborhood and improve connections to nearby trails outside of the neighborhood.

Mechanism

Each action should have a specified mechanism, which explains the manner in which the action is expected to support the goal. When published literature that supports the mechanism has been reviewed, then such literature and any differences between the context of the literature and of the particular neighborhood should be briefly summarized and continually reviewed and updated; however, expert research is not necessary in order to state the expected mechanism. Hypothesized mechanisms can be just as useful to the planning process as proven mechanisms, because many of the ways in which a neighborhood affects its residents and the environment can be intuitive. In addition, hypothesized mechanisms can support new and innovative ideas, which may not yet have been studied by the scientific community. The purpose of the mechanism is merely to provide explicit justification as to why each action is desirable for the particular neighborhood at the time the plan was created.

An example mechanism related to renewable energy might be that it is expected that by providing financial incentives for the installation of onsite renewable energy

systems, the increase in onsite energy production will outpace any increases in energy use, thereby reducing the per capita energy consumption within the neighborhood. An example mechanism related to trail construction might be that it is expected that increasing the miles of trails will increase levels of physical activity, which has been proven to reduce obesity.

Though many of the mechanisms may seem obvious or intuitive and, therefore, easy to omit, conscious effort should be focused on ensuring their written inclusion, as they are crucial for future evaluation of the sustainable neighborhood code. When updating a code and deciding whether or not a particular action is still desirable for a neighborhood, the mechanism can be evaluated to determine whether it has thus far proven to have the intended effect and whether it is likely to continue having the same effect into the future. In addition, a mechanism that works in one particular place and time may not work in another, so, without explicitly stating the mechanism, it can be difficult to predict whether or not the action would still be effective should the code ever be borrowed by others for which it was not explicitly developed.

Indicator

An indicator must be something that can be measured to determine whether or not the goal is being met, ideally due to the related action mechanisms. The indicator can be either quantitative or qualitative. A method for collecting indicator data should be proposed in the code. Some indicator data may already be available through city, state, or national agencies. Other indicator data may need to be collected locally. When local data must be collected, residents should be involved however possible so that they become aware of the code and invested in its effects. Establishing an indicator is important because, unlike actions for which the status can be simply tracked as complete or

incomplete, it can be difficult, and often subjective, to determine whether or not a broad-level goal has been met. The use of indicators can help to track the progress of goals and to determine whether or not actions are having their intended effect upon the goals.

Baseline

The baseline reflects the status of the indicator at the time the code was created or revised. It is important to establish a baseline measurement as part of the code. An assessment of existing conditions allows for the opportunity to reflect upon which portions of the vision are already being supported and which portions require the most work to achieve. Baseline measurements also help to determine whether additional actions are even necessary and whether the purpose of the actions should be to improve conditions or to maintain the status quo. The baseline need only be established at the time that each indicator is selected; however, if the indicator will be measured over a significant period of time, such as several decades, then it may be prudent to update the indicator baseline once major milestones are achieved.

Target

The target reflects the ideal status of the indicator at some future point in time. It is important to set a target so that the direction, magnitude, and speed of change desired by the neighborhood can be discussed and reflected in the plan. Ideally, a date should be set to achieve this target, if change is required. The target date can provide incentive to complete actions which often fall outside of the typical day-to-day duties of those involved. If immediate change or action is not required, then the target may establish a standard which can be used to continuously evaluate whether actions are necessary in the future.

Distribution

Because a large portion of any neighborhood planning and coding process is devoted to educating citizens and because plans need continuous support from citizens, government, and private parties in order to get implemented, the contents of each code need to be published, distributed, and promoted to all parties who might be able to assist with implementation.

The amount of time, devotion, and creative collaborative ideas that are invested into the creation of neighborhood codes is tremendous, but, often, at the end of the planning process, citizens are not immediately rewarded for their efforts and gradually lose interest in carrying out their visions. Eventually, only those required to reference codes as part of their job duties refer to them on a regular basis. To continue the momentum established by the planning process, it is essential to plan for ways to continue promoting the goals and actions included in the plan to all audiences. Constituents of neighborhoods can change frequently, as can the status of goals and actions, so updates reflecting these changes should be provided on a regular basis.

Evaluation

The evaluation section of the code should include a desirable timeline and method for evaluating each of the other code elements in the future. In general, the elements I have listed later in this section of proposed sustainable neighborhood code elements should be evaluated more frequently. Evaluation involves two key components. The first component involves an analysis of the effectiveness of the chosen actions and their related mechanisms for meeting the goals and the second involves evaluation as to whether the intent or vision of the code continues to reflect the values of the neighborhood for which it was created.

In order to monitor the effectiveness of the code, targets should be evaluated as frequently as possible. Constant feedback regarding the current status of each indicator can be valuable. Measureable demonstration of progress towards the target can be motivating and can communicate to the community that their effort is having the desired effect. On the other hand, a lack of progress can spur more immediate action or trigger an evaluation as to whether the intended actions are really most appropriate for meeting their goals. If it looks like the target will be met much earlier than anticipated, a new and more ambitious target can be set to further improve the community. On a less frequent basis, the vision and goals of the code should be evaluated to determine whether or not they still reflect the views of the community.

Another simpler aspect of evaluation is simply to ensure that the code takes into consideration the present state of knowledge. For example, a building code designed with the intent of pushing the envelope for energy efficiency past the status quo could become so entrenched in our building culture that it becomes the standard beyond which no one builds below anymore. In other words, the code could be so successful at changing the expectations and being adapted by businesses and consumers, that it could become obsolete. Peterson provides this criticism of Green Seal, in that they did not keep up to date on progress within the industry, thereby making their standards irrelevant.[107] I would argue that the codes that are most effective at spawning the type of civilizational change described by Feenberg are those that do make themselves irrelevant, meaning the only way to ensure they are sustainable into the future is to ensure they have the ability to adapt as knowledge changes.[108]

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[107] Peterson, "A Comparative Analysis of Sustainable Community Frameworks," 6.

[108] Feenberg, "Incommensurable Paradigms: Values and the Environment."

Supporting Elements

In order for a citizen base to effectively incorporate these recommended elements into their neighborhood codes, it is necessary to have a publicly accessible database to facilitate education and communication. In this case, the term database does not necessarily refer to a traditional compendium of information at one central location, but more of an active and participatory means of communicating existing knowledge and prior experiences. It is likely that in today's society much of this knowledge would reside online and would be discussed through social media.

In order for citizens to make informed choices as to which actions they feel would best support their goals, they should be able to access easily comprehensible summaries of research, best practices, and expert opinions. Each summary should be condensed into a few sentences written in clearly defined language to be accessible to the widest audience possible. This database could grow based on the shared knowledge accumulated through each neighborhood planning process.

Example actions and implementation methods could also be provided. These examples should not be intended to limit ideas, but rather to share ideas that may not have otherwise been generated within a particular neighborhood. One benefit of sharing the actions that have been incorporated in other neighborhood codes is that it allows for greater collaboration. If one neighborhood cooperatively agrees to the goals, actions, and mechanisms of another neighborhood, then the actions can be implemented on a larger scale.

Though it has been recommended that indicators be used in order to measure progress, it may be difficult for citizens to determine appropriate indicators to use, especially without knowing what data might be available to them. In fact, Peterson suggests that one reason why high-level frameworks have not been successful at being

adopted as part of government or business sustainability models is that "the user is required to develop her own metrics by which to measure whether they are heading toward or away from compliance with system conditions."[109] My hope is that if indicators are more widely adopted as a standard part of neighborhood codes, then there would be a much broader base of published indicators and data sources from which organizations could borrow. For this reason, example indicators that can be measured based on available or collectable data should be provided to citizens for evaluation for use in their own neighborhood codes. Since typical indicator data is commonly difficult for most citizens to obtain, particular efforts should be made either by the agencies providing the data or by an umbrella neighborhood planning organization to share the data in an accessible manner. There is also a great need for data collection at the individual neighborhood level, if coding is to be carried out at this level.

Finally, tracked changes in indicators should be shared across neighborhoods. Though positive indicator changes by no means prove the causal effectiveness of actions and mechanisms according to the scientific method, they can be used as evidence to help other neighborhoods determine whether or not similar actions might be appropriate in their particular situation.

I believe that providing all of the elements described above in the context of public participation and consensus-based decision making will ensure the transparency and flexibility required for codes to remain sustainable into the future. I will now analyze two particular neighborhood codes as examples of the various sustainability frameworks laid out in this chapter.

[109] Peterson, "A Comparative Analysis of Sustainable Community Frameworks," 5.

Chapter 5: Analysis

COMPARATIVE ANALYSIS

The following provides a comparative analysis of the general intent, outcome, accessibility, participants, incentives and structure of the LEED-ND and HDMT metrics.

Organization Missions

I first compared the missions, visions, and values of the organizations that developed the two sustainability metrics to help determine whether or not any differences found between the two metrics themselves might be due to fundamental differences in the goals of the organizations that developed them. The value in this comparison is based on the assumption that the organizations have worked to ensure that their metrics accurately reflect and promote their missions. In reality, there are undoubtedly numerous competing factors within these organizations and in their relationship with citizens, the government, and private entities that prevent such an idealistic situation.

The mission for each organization involved in the creation of LEED-ND and the HDMT was obtained from the respective organization's website. All organizational missions are presented in their entirety in Appendix B.

The LEED-ND metric was developed by the U.S. Green Building Council (USGBC) in collaboration with the Congress for the New Urbanism (CNU) and the Natural Resources Defense Council (NRDC). All three organizations are based in the United States, though all have a degree of international involvement. Each organization has a unique, but complimentary, focus and scale. The NRDC operates at the largest scale and focuses on humans and the environment in a broad sense, frequently mentioning such all-encompassing terms as the "Earth," its "natural systems," and "humankind."[110] CNU

[110] Natural Resources Defense Council, "About NRDC: Mission Statement," *NRDC: Natural Resources Defense Council - The Earth's Best Defense*, n.d., http://www.nrdc.org/about/mission.asp.

and USGBC both focus more specifically upon the design of the built environment. While CNU deals with the design of cities and towns and, in particular, urban centers, USGBC focuses on the design of individual buildings, or, in the specific case of LEED-ND, the design of neighborhood developments.

The three organizations also differ in the primary mechanisms by which they promote change, though they are all involved to some degree in public policy. The USGBC mission specifically mentions a desire to influence the design, construction, and operation of buildings.[111] Given that a large portion of the work performed by the USGBC is the development and oversight of metrics, they are also obviously interested in developing some form of public policy or regulation as a means of promoting their goals. Their Articles of Incorporation confirm this desire by stating that the first two purposes of the organization are to "stimulate the creation of American Society of Testing Materials ('ASTM') national 'green building' specifications" and to "develop and implement a strategy to incorporate the specifications into state and local building codes."[112] Their more recently revised Articles of Amendment have become more broad in scope to encompass research, education, and advocacy, but still mention a desire "to develop standards for the design, construction and renovation of 'green buildings' and their associated surroundings."[113] CNU openly states in its mission that it deals with both public policy and urban design and planning.[114] The mission for NRDC is so broad and

[111] U.S. Green Building Council, "About USGBC," *USGBC: U.S. Green Building Council*, 2011, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=124.

[112] U.S. Green Building Council, "Articles of Incorporation, U.S. Green Building Council, Inc.", April 6, 1993, http://www.usgbc.org/ShowFile.aspx?DocumentID=6586.

[113] U.S. Green Building Council, "Articles of Amendment to Articles of Incorporation of U.S. Green Building Council, Inc.", September 25, 2002, http://www.usgbc.org/ShowFile.aspx?DocumentID=6587.

[114] Congress for the New Urbanism, "CNU History," *Congress for the New Urbanism*, 2011 1997, http://www.cnu.org/history.

vision-oriented that it does not mention the specific mechanisms thorough which it wishes to promote change; however, an exploration of their website confirms that they deal primarily with public policy and advocacy.

All three organizations at least mention some aspect of environmental, human, and societal health in their missions. USGBC specifically mentions environmental sustainability, health, quality of life, social responsibility, equity, and the economy.[115,116] Though CNU focuses on the restoration of the built environment, it emphasizes the interdisciplinary nature of the built environment and includes references to environmental conservation, health, community, design, and economics.[117] In contrast to USGBC and CNU which encompass a broader view of sustainability, NRDC seems to focus primarily on the natural environment and equity.[118] Though emphasis is not placed specifically on human health, design, or the economy, those topics are broadly alluded to as they apply to equity and quality of life.

Overall, it seems that these three organizations span different scales (buildings, cities, and the planet) and rely upon different mechanisms of change (coding, design, and public policy), but that all share common goals related to sustainability and acknowledge the role that our planning and design of the built environment plays on environmental, human, and societal health.

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[115] U.S. Green Building Council, "About USGBC."

[116] U.S. Green Building Council, "USGBC Guiding Principles," *U.S. Green Building Council*, n.d., http://communicate.usgbc.org/usgbc/2006/08.15.06_guiding_principles/guidingPrinciples/.

[117] Unless it was a typo on my part, CNU appears to have specifically added health to its mission between 2009, when I originally recorded their mission, and 2011, when I first noticed it had been added.

[118] Natural Resources Defense Council, "About NRDC: Mission Statement."

Though numerous organizations from a multitude of fields undoubtedly provided input, there was only one main organization involved in the creation of the HDMT: the San Francisco Department of Public Health (SFDPH). Nevertheless, it is interesting to compare the work of different levels of departments within the organization. Within SFDPH, the HDMT was developed by the Urban Health and Place Team in the Program on Health, Equity and Sustainability (SFPHES) within the Environmental Health Section.

The mission of SFDPH focuses exclusively on human health and equity and does not at all mention the environment. The mechanisms through which it promotes change include research, education, public services, and policy.[119] The Environmental Health section integrates environmental health into the SFDPH mission, as it "strives to protect and improve health and quality of life […] by improving the environmental quality" through the implementation of policies and laws.[120] SFPHES further integrates societal health into the SFDPH mission by specifically addressing social and environmental justice, education, the economy, and public participation.[121] Finally, the Urban Health and Place Team addresses all aspects of the SFDPH mission mentioned thus far, but specifically as they relate to elements of the built environment, including "land use, transportation, housing, water, air quality, noise quality, climate, and other aspects of health."[122] The Urban Health and Place Team also seeks to facilitate decision-making

[119] San Francisco Department of Public Health, *San Francisco Department of Public Health 2009-2010 Annual Report*, n.d., 2, http://www.sfdph.org/dph/files/reports/PolicyProcOfc/2009-2010AnnlRpt/2_InsideFrontCover.pdf.

[120] San Francisco Department of Public Health, "Environmental Health," *San Francisco Department of Public Health*, n.d., http://www.sfdph.org/dph/eh/.

[121] Department of Public Health, City and County of San Francisco, "Program on Health Equity and Sustainability Mission," *Program on Health Equity and Sustainability*, September 13, 2010, http://www.sfphes.org/phes_mission.htm.

[122] San Francisco Department of Public Health, "Urban Health & Place."

regarding development and public policy specifically through the use of health impact assessment tools which they develop. It appears each sub-department within SFDPH more closely links its overall mission of promoting human health with the complementary goals of promoting environmental and societal health.

Overall, I would say that the missions and values of the organizations that developed LEED-ND and the HDMT are rooted in separate fields, but ultimately bridge the gap to encompass the same broad set of topics revolving around sustainability. While LEED-ND organizations focus more on the quality of both the natural and built environment, they recognize their simultaneous ability and desire to improve human and societal health. The HDMT departments are obviously primarily interested in promoting human health, but recognize that a powerful means of doing so is by regulating the built environment and that neighborhoods that are best for human health are also best for environmental health. While the overall visions of both sets of organizations appear to be fairly similar, the approaches of achieving such visions through the development and implementation of metrics are quite different, as will now be discussed.

Metric Outcomes, Accessibility, Incentives, and Sustainability

The mission of LEED states that it "encourages and accelerates global adoption of sustainable and green building and neighborhood development practices through the creation and implementation of a universally understood and accepted benchmark encompassing existing and new standards, tools, and performance criteria."[123] In addition, the LEED strategic goals indicate the desire to "promote the tangible and intangible benefits of green buildings, including environmental, economic, human health,

[123] U.S. Green Building Council, "Foundations of LEED", July 17, 2009, 3, http://www.usgbc.org/ShowFile.aspx?DocumentID=6103.

and social benefits" and to ensure widespread endorsement throughout private and public industry and all levels of government, both in the US and abroad.[124]

The primary outcome of LEED-ND is that the neighborhood development project will earn official LEED certification at one of four levels: Certified, Bronze, Silver, or Platinum. The certification level achieved depends on the number of credits the project has earned for meeting certain minimum requirements related to a wide variety of goals. Several credits are mandatory and called prerequisites, while the majority of credits are optional, but contribute towards the minimum amount of points required for each certification level. USGBC claims that "the allocation of points is split between direct human benefit and direct environmental benefit."[125] Regarding the framework types outlined by Patterson, LEED-ND is an example of a designation system at the neighborhood scale.

There is significant cost, effort, and expertise involved in earning LEED certification for a project. Therefore, average individuals and some small businesses would not be likely to pursue LEED certification, even if their projects would qualify and they embraced the importance of sustainable design, making the certification system somewhat exclusive. Instead, the system targets large-scale developers and governmental organizations. Even obtaining the reference guides which outline the full requirements and recommended strategies for earning each credit cost hundreds of dollars. You are also required to pay for their training courses regarding LEED implementation and for test preparation materials to become a LEED Accredited Professional (AP), which certifies that you are an authority on the implementation of the LEED certification

[124] Ibid., 4.

[125] Ibid., 12.

systems. Though you are not required to be a LEED AP in order to earn LEED certification for your project, USGBC's heavy promotion of the credential and the added incentive of granting a project credit merely for having a LEED AP on your project team, further relegates the rating system to the realm of professionals. Due to the enormous costs of even obtaining educational materials related to learning how to implement LEED, much less the cost, time, and knowledge required to pursue official certification, I would argue that the ability of LEED to provide general community education and to be implemented by any interested and motivated individual is limited.

Perhaps one advantage of LEED-ND over the other LEED rating systems geared towards individual buildings is that entirely new neighborhoods are almost always developed by larger corporations or public-private partnerships that are more likely to have the resources required to pursue LEED-ND certification. One notable exception might be small community development corporations (CDCs) wanting to certify existing neighborhoods after small redevelopment projects and improvements have been made. The difficulty of implementing LEED-ND is evident in that, as of 2012, less than half of the 239 pilot projects registered between 2007 and 2011[126] have even received Stage 1 Certified Plans,[127] which simply grant conditional approval before embarking on the entitlement and public review process.[128] Beyond that, a mere 13 projects have received Stage 3 Certification, meaning that the development has been constructed and earned sufficient credits for official and final certification. Granted, full neighborhood

[126] U.S. Green Building Council, "LEED for Neighborhood Development Registered Pilot Projects and Plans List - Updated 07/14/11."

[127] U.S. Green Building Council, "LEED for Neighborhood Development Certified Pilot Projects and Plans List", August 18, 2012, http://www.usgbc.org/ShowFile.aspx?DocumentID=5205.

[128] U.S. Green Building Council, "LEED for Neighborhood Development FAQ", n.d., 1, http://www.usgbc.org/ShowFile.aspx?DocumentID=6423.

development projects can take many years to complete, but it seems that by the time a project has been conceived sufficiently enough to register for LEED-ND in the first place that at least preliminary plan proposals would be in place within a few years.

Despite the obstacles to implementation, there are numerous economic incentives for achieving LEED certification. Because LEED rating systems have already been embraced by numerous government agencies, it is likely that economic and logistical incentives would be provided by these governments to certified projects to encourage sustainable development practices within their region. Another incentive is that potential residents and businesses who value the benefits of living in a neighborhood designed with sustainability in mind may be more likely to occupy a LEED-ND certified development and may also be willing to pay more for the particular quality of life they perceive it will provide. Finally, because LEED is a nationally recognized standard, a company that has completed a LEED certified project will inevitably receive recognition and publicity, thereby generating future business as the demand for LEED-ND developments grows.

Regarding my definition of a sustainable code as one that is easily adaptable to changing conditions and shifting societal values, USGBC has been committed to continually reviewing and adapting their metrics since its inception. The strategic goals for LEED state the desire to "lead the industry state of knowledge about practical implementation of the most up-to-date and practical innovations" and to "improve LEED performance criteria as the industry gains experience with integrated design, green construction, and sustainable operations and maintenance."[129] USGBC releases new versions of LEED every few years and conducts an involved public review and comment

[129] U.S. Green Building Council, "Foundations of LEED," 4.

process with several iterations for each new version. With LEED-ND in particular, they have made redlined copies of each updated version of the code available for free online, allowing anyone to easily identify and comment on the changes that have been made. They also post responses to every public comment received, indicating either that they have updated the metrics based on the comment or explaining the reason they chose not to. I believe that because LEED metrics are developed outside of the government, they can be much more responsive in a timely fashion. If a government mandated LEED certification, the LEED metrics could be continuously updated without necessarily having to update the government mandate itself.

LEED-ND also allows for developments to earn up to four regional priority credits with the intent "to encourage strategies that address geographically specific environmental, social equity, and public health priorities."[130] While these regional priority credits do acknowledge potential differences in the physical and cultural conditions of different communities and recognize those designs that cater to them, they do little to ensure that the majority of the credits are adaptable to local conditions, though most credits do offer several options for compliance to account for at least some of these local variations. Though the concept has not yet been applied to the LEED-ND rating system in particular, other LEED rating systems now feature global alternative compliance paths to facilitate adoption in other countries.[131] There is a webpage of LEED-ND resources for international projects, which states that "USGBC is soliciting feedback from all international projects to determine if the rating system encourages

[130] Congress for the New Urbanism, Natural Resources Defense Council, and U.S. Green Building Council, "LEED 2009 for Neighborhood Development Rating System" (U.S. Green Building Council, February 2011), 109.

[131] U.S. Green Building Council, "LEED 2009 Global Alternative Compliance Paths FAQ", n.d., https://www.usgbc.org/ShowFile.aspx?DocumentID=19179.

regionally and culturally appropriate planning and design decisions outside of the U.S."[132] Overall, I would say that the LEED metrics have shown to be sustainable regarding shifting conditions, knowledge, and values over time, but that they would not yet be sustainable when adapted in a variety of different places and cultures.

Unlike LEED-ND which provides a nationally standardized project certification, the primary outcome of the HDMT is a comprehensive analysis of the potential impacts of a particular development project upon baseline indicators measuring the existing environmental, health, and social conditions of a community. Regarding the framework types outlined by Patterson, the HDMT is an example of an indicator initiative at the neighborhood scale.

Though a certain amount of dedication and knowledge would be required to carry out some form of the HDMT, the metric is inherently more democratic than LEED-ND, because the process is fully documented online and can be obtained and conducted for free. In San Francisco, where the metric was designed, all of the baseline data for each indicator for each neighborhood is also made available online and has been updated yearly. This data is presented in both tabular form and a visual map highlighting existing differences between the individual neighborhoods. Since there are no particular requirements to meet in order to conduct the HDMT, communities may perform as much or as little of the analysis as is justified given their particular set of circumstances or as time, resources, and interest permits.

Unlike LEED-ND, which provides national recognition and financial incentives and is largely pursued by the private sector, the incentive for carrying out the HDMT is entirely self-generated by a community who desires to use the framework as a means of

[132] U.S. Green Building Council, "USGBC: Neighborhood Development - Non-US," *U.S. Green Building Council*, 2011, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=2489.

organizing and evaluating their short-term and long-term planning and development processes. It is neither required nor financially incentivized and it does not bestow any official recognition, other than that generated within the community itself.

Because the HDMT serves as a framework for evaluation methods, but does not have any particular requirements, it is also an inherently more sustainable metric according to my definition. Unlike LEED-ND, which is always implemented in accordance to a nationwide standard, the HDMT has always been adapted and rebranded by other localities to incorporate the methodology into a unique framework that is most appropriate for assessing baseline indicators and project impacts that are sensitive to a particular region with particular values at a particular time.

For example, after Hurricane Ike, the Center to Eliminate Health Disparities adapted the HDMT framework to create the Galveston Health in All Policies Project (G-HAP). Because G-HAP was situated in a post-disaster and recovery context, the project team integrated situated considerations into the methodology, including developing indicators regarding the "distribution of pre-disaster population that has returned, assessment of new threats immediately post-disaster, and community voice in recovery and planning efforts," as well as "identifying new methods for data collection as many databases are not current after a disaster" and "recognizing and taking into account the needs of the displaced population."[133] Again, because the HDMT provides a process of evaluation, rather than mandating particular objectives, it allows for flexibility as new communities develop, research is performed, and knowledge and values change.

In summary, while LEED-ND provides a standardized national certification system for development projects, the HDMT provides a framework for establishing

[133] The University of Texas Medical Branch, "Galveston Health in All Policies Project (G-HAP)," *Center to Eliminate Health Disparities*, April 20, 2012, http://www.utmb.edu/cehd/Galveston-HAP.html.

baseline indicators and assessing the impact of a development project. Overall, the HDMT is more accessible, educational, and easier to adopt. That said, it requires a greater initiative on the part of the participants to adopt it in a context sensitive manner and does not provide the same incentives for implementation as LEED-ND. There are also greater challenges to adopting the HDMT outside of San Francisco, because baseline indicators corresponding to the HDMT objectives have likely not been gathered in a centralized online database and may not even exist at all. With regards to sustainability, both metrics have been continuously revised over time, integrating new values, goals, and standards, but only the HDMT seems fairly sustainable across a variety of places and cultures.

Metric Structure

Though the outcomes, accessibility, incentives, and sustainability of LEED-ND and the HDMT are quite different, the two metrics do have a similar structure. The primary elements within LEED-ND are called credits, which are organized into four categories. Each credit has a stated intent, often outlining the intended purpose and expected results. Though most of the statements of intent are specific in their intended goals, they do not in and of themselves prescribe a certain method of achieving such goals and could therefore be considered performance-based, though actual measures of performance are not provided. Each credit also has a detailed list of requirements that must be met in order for the credits to be achieved. These requirements are usually prescriptive, though several alternative options for achieving each credit are often provided. Finally, key terms are italicized throughout the metric and are defined in significant detail at the end of each credit.

In the *LEED for New Construction and Major Renovation Version 2.2 Reference Guide* from October 2007, (which must be purchased, unlike the base rating system, which can be obtained for free), each credit also includes a section on approach and implementation, referenced standards, calculations, and submittal documentation. Most notably, they also include a considerations section with individual headings for environmental issues, economic issues, community issues, cost issues, regional issues, and synergies and trade-offs.[134] While required actions are fully outlined in both the *Rating System* and the *Reference Guide*, the mechanisms and goals are much more elaborately described in the considerations section of the *Reference Guide* and are less frequently mentioned within the *Rating System* itself. In the early stages of LEED-ND, only the *Rating System* was available. Though the supplemental *Reference Guide* has since been published, I have not evaluated it and cannot speak as to its contents. While I do not consider the *Reference Guide* to be part of the official metric, nor is it accessible in any case for the purposes of transparently communicating the values and reasoning behind the code to the general public, I nonetheless hope that it contains more detailed information relating the proposed actions to their intended effects regarding environmental, human, and societal health.

The HDMT is organized into six categories, called elements of a healthy city. Within each of the six elements are numerous community health objectives. Each objective provides several measurable indicators (and corresponding baseline data for neighborhoods in San Francisco) that would be useful in evaluating progress towards that objective. For each indicator, there is a development target which states a quantifiable goal, so that the particular development project can be evaluated based on whether it is

[134] U.S. Green Building Council, *LEED for New Construction Version 2.2 Reference Guide*.

likely to shift the indicator closer to that development target. Example policies, actions, and designs that may help achieve these targets are mentioned. Finally, a health-based rationale is included to summarize the relevant literature on the objective and state the connection between the actions being recommended, the indicators that are being measured, and the corresponding objective.

Regarding the elements that I feel should be included in any sustainable metric for the evaluation of neighborhood-scale projects, the organization of both metrics provides an appropriate structure to outline the vision, goal, action, and mechanisms, though the extent to which these are explicitly written for each credit and objective varies, as will be further discussed in the results of the content analysis. Only the HDMT uses indicators, baselines, and targets to measure the status quo and monitor progress towards a particular goal. Neither metric specifically addresses how to publicize and distribute information regarding the metric and the results of the analysis throughout the community.

The organizations sponsoring both metrics obviously have processes in place for continuously evaluating and updating the metrics, as is evidenced by the frequency that new versions of both metrics are released, but such information is not included within the text of the metrics themselves. The HDMT does provide a free online database of published research relating to each indicator in their health-based rationale section and also provides the indicator data online. I do not think it would be practical for the HDMT website to be able to publish data for all indicators everywhere, but it should be noted that creating a similar resource for another location would represent a significant amount of work.

Overall, LEED-ND provides a metric that is suitable for the near-term planning, design, and evaluation of community development projects, but does not have an indicator system in place to set long-term goals beyond the scope of a single project and

to monitor the cumulative long-term effects of multiple development projects over decades, as the HDMT provides. While the HDMT does address all of the elements of a sustainable code I have mentioned for use specifically in San Francisco, many elements of the HDMT would need to be reworked for use elsewhere, thereby limiting immediate use in other locations. In fact, Peterson expresses that "high-level frameworks […] have experienced difficulty becoming established in the vocabulary of government or business sustainability—perhaps because the user is required to develop her own metrics by which to measure whether they are heading toward or away from compliance with system conditions."[135]

Metric Categories

LEED-ND and the HDMT differ in the organization of their credits and objectives. The credits in LEED-ND are organized into five categories based loosely on their geographic extent:

- Smart Location & Linkage
- Neighborhood Pattern & Design
- Green Infrastructure & Buildings
- Innovation & Design Process
- Regional Priority Credit

The first category rates the manner in which both the site is situated within the larger community and the individual project is situated within the site. The second category rates the organization of the project itself and the third category rates features of individual buildings within the project. The final two categories provide credits for innovative and regional design and including a LEED AP in the project team. The credits

[135] Peterson, "A Comparative Analysis of Sustainable Community Frameworks," 4–5.

in these final two categories were excluded from the content analysis, since they do not specify particular goals.

In contrast, objectives in the HDMT are organized into six categories based on subject area:

- Environmental Stewardship
- Sustainable and Safe Transportation
- Social Cohesion
- Public Infrastructure/Access to Goods and Services
- Adequate and Healthy Housing
- Healthy Economy

In this scheme, all credits related to each topic are listed together regardless of the scale at which they operate.

There are potential advantages to each method of organization. One advantage of categorizing by scale is that, in general, they correspond to the logical order of the design process. For any project, it is likely that the site will first be selected, then the general community plan will be laid out and, finally, the individual buildings will be designed. Similarly, these categories correspond to the specialized work of professionals in a particular field. For example, community and regional planners would situate the project site within the context of the larger community, urban designers would lay out the overall design of the development, and architects would be primarily concerned with the design of the individual buildings within the project. A primary disadvantage of organizing the credits by scale (which is a simultaneous strength of organizing credits by topic), is that it can be more difficult to determine how credits at different scales may ultimately be interrelated. Either method involves some degree of interdisciplinary collaboration; however, the organization of LEED-ND is more suited to having professionals work

somewhat independently on the portions of the project that are most relevant to them, whereas the organization of the HDMT would force professionals to work collaboratively on each topic category.

LEED Credit Categories	Prerequisites	Credits
Smart Location & Linkage	6	9
Neighborhood Pattern & Design	3	15
Green Infrastructure & Buildings	4	16
Innovation & Design Process	0	6
Regional Priority Credits	0	4
TOTAL	**13**	**50**
HDMT Elements	**Objectives**	**Indicators**
Environmental Stewardship	5	18
Sustainable and Safe Transportation	3	21
Social Cohesion	3	22
Public Infrastructure	8	42
Adequate and Healthy Housing	4	17
Healthy Economy	4	13
TOTAL	**27**	**133**

Table 5: Summary of Credits and Objectives by Category

CONTENT ANALYSIS

In order to analyze the content of the individual credits and objectives in each metric, a content analysis was conducted according to the methods detailed in Chapter 3. The complete coded results of the content analysis are presented in Appendix C. Both metrics are updated very frequently, but the particular editions analyzed in this study were the *LEED 2009 for Neighborhood Development Rating System* last updated in February 2011[136] and the *HDMT Version 3.01* last updated in September 2009.[137]

[136] Congress for the New Urbanism, Natural Resources Defense Council, and U.S. Green Building Council, "LEED 2009 for Neighborhood Development Rating System."

[137] San Francisco Department of Public Health, "Healthy Development Measurement Tool Version 3.01", September 2009.

The first set of results are displayed in Table 6 and summarize the presence of manifest actions, mechanisms, and goals as they relate to environmental, human, and societal health goal categories.

	LEED-ND			HDMT		
	Action	Mech.	Goal	Action	Mech.	Goal
Environmental Health	94%	70%	58%	74%	52%	33%
Human Health	94%	53%	25%	100%	67%	89%
Societal Health	85%	36%	17%	100%	59%	74%
Any Goal	100%	89%	81%	100%	85%	100%

Table 6: Manifest Content by Goal Category Expressed as a Percentage of Total Credits/Objectives within Each Metric

Both metrics were thoroughly successful at communicating recommended actions within their manifest content, reinforcing the notion that the purpose of a code is generally to ensure that particular actions will be implemented. There were no instances where mechanisms or goals were outlined in the manifest content of these metrics without accompanying actions designed to achieve such goals. In Table 6, any percentages less than 100% for the explicit inclusion of actions in the metrics are due to the small percentage of credits and objectives that I could not determine to be applicable to one of the three goal categories based on either the manifest or latent content of the corresponding mechanisms and goals.

It should also be noted, that while the action itself may have been manifest, the decision to include it as a manifest action within a particular goal category was based entirely on the goal, which may have been manifest or latent. In other words, because no mechanisms or goals were listed without corresponding actions, the percent of manifest actions for a single goal category equals the percent of all credits/objectives in the metric related to each goal category when accounting for both the manifest and latent content for the mechanisms and goals. Therefore, the difference between the percent of mechanisms

or goals and actions within the same category represents the percentage of latent content. For example, 94% of all LEED-ND credits were related to environmental goals, though only 58% of all credits specifically mentioned environmental goals in their manifest content. Therefore, 36% (or 94% minus 58%) of all credits contained latent environmental goals, while the remaining 6% of all credits did not relate to environmental goals at all. Using this same formula and excluding all credits that were not at all related to a particular goal category, Table 7 summarizes the latent mechanisms and goals as a percentage of total credits related to each category, (rather than as a percentage of all credits).

	LEED-ND		HDMT	
	Mech.	Goal	Mech.	Goal
Environmental Health	26%	38%	30%	55%
Human Health	44%	74%	33%	11%
Societal Health	58%	80%	41%	26%

Table 7: Latent Content by Goal Category Expressed as a Percentage of Total Credits/Objectives Related to That Goal Category

Across all three goal categories within LEED-ND, mechanisms were latent for 26% to 58% of applicable credits and goals were latent for 38% to 80% of applicable credits. It is also interesting that both mechanisms and goals were latent significantly more with regards to human and societal health goals than environmental goals. The main reason that LEED-ND had a significantly higher percentage of latent goals than mechanisms is that the manifest intents expressed within the credits were frequently more closely aligned with mechanisms than goals.

An example of a LEED-ND credit where the listed objective was a mechanism, rather than a root-level goal, is *SLL Prerequisite 4: Agricultural Land Conservation*. The stated intent is “to preserve irreplaceable agricultural resources by protecting prime and

unique soils on farmland and forestland from development."[138] In this credit, conservation of farmland is taken as an inherent good that requires no explanation. In reality, the very concept of "farmland" is a completely human construct. The decision to preserve farmland over other types of land cover, land uses, and ecosystems which could ultimately serve a wide variety of other environmental and human needs is one that requires some rationale. The ultimate decision as to whether or not it is important to preserve farmland depends upon relating the particular mechanism of conserving farmland to more broad-level goals.

For example, regarding environmental goals, it is likely that prime and unique soils are also good for supporting a variety of native plant and animal species and preventing runoff, which can lead to water pollution and associated hazards. In addition, the ability to grow food locally can reduce the pollution and natural resource consumption associated with transporting food over long distances. Regarding health goals, local food security will help to ensure adequate nutrition without dependence upon imported foods. Local food can also be more nutritious than food that has been transported over a long period of time and can be more closely monitored in terms of growing practices, such as fertilizer and pesticide use. Regarding societal goals, perhaps there is significance to being able to preserve the cultural tradition of farming in America and the associated way of life. From an economic standpoint, we need to provide farmers with sufficient earnings to continue farming to ensure we have an adequate domestic food supply well into the future. There may also be economic benefits to spending money on food produced within the country while reducing imports or to bringing additional money into the country by exporting surplus food supplies. These are all examples of potential

[138] Congress for the New Urbanism, Natural Resources Defense Council, and U.S. Green Building Council, "LEED 2009 for Neighborhood Development Rating System."

goals that can perhaps be facilitated by preserving farmland, but it remains unknown as to which of these goals the USGBC was ultimately trying to achieve through implementation of this credit and, therefore, makes it difficult for those evaluating the metric to determine whether or not they agree with conserving farmland as an appropriate means of achieving the goal.

Reducing motor vehicle use was another common theme that was typically stated as a self-evident goal, when there is not much inherently wrong with using motor vehicles as a form of transportation. In fact, for the better portion of the twentieth century, it was a largely celebrated activity and cities and neighborhoods were designed almost exclusively to facilitate transportation by private automobile. It was not until much more recently that the negative side effects of this form of development were observed and I would guess that a large portion of the general public is still not consciously aware of the potential negative influence of our heavy reliance on private automobiles upon environmental, human, and societal health.

Like LEED-ND, the HDMT was also far more successful at communicating actions in the manifest content, than mechanisms or goals, but, in contrast to LEED-ND, the HDMT actually contained less latent goals (11% to 26%) than latent mechanisms (33% to 41%), as related to both the human and societal health goals, but did contain more latent goals (55%) than mechanisms (30%) as related to environmental health goals.

Between the two metrics, the HDMT was more successful at explicitly including mechanisms and goals in the manifest content of the metric. I believe this has to do with the overall structure of the metrics. While LEED-ND lists only an objective and specific actions to meet that objective, the HDMT also includes an indicator and rationale section, which often provide an extra opportunity to explain mechanisms and goals as supported

by prior research literature. It is also possible that additional mechanisms and goals were included in the *LEED-ND Reference Guide*, which was not analyzed.

As predicted in my hypothesis, a greater percentage of all credits and objectives were directly related to environmental health in LEED-ND than in the HDMT and, similarly, a greater percentage of all credits and objectives were directly related to human health and societal health in the HDMT than in LEED-ND, but despite these topical biases towards the fields from which each code was generated, it is critically important to note how small the differences in percentages by category are between the two metrics. Ninety-four percent of the actions recommended in the LEED-ND metrics have the potential to directly impact human health, despite that only 25% of the metrics explicitly state these health outcomes as goals. Similarly, 74% of the actions recommended in the HDMT metrics have the potential to directly impact environmental health, while only 33% of the metrics explicitly state these environmental outcomes as goals.

Code documentation should not be so long and complicated as to hinder comprehension and discourage use, nor can codes possibly aim to list every theoretical outcome that may result from their implementation; however, it seems that the opportunity to easily recruit an entire professional field with which to share expertise and resources, not to mention overall support of one's cause, is too good of an opportunity to overlook.

	LEED-ND	HDMT	DIFFERENCE
Environmental Health	**94%**	**74%**	**LEED + 20%**
Conserve species diversity	36%	19%	LEED + 17%
Conserve natural resources	77%	63%	LEED + 14%
Reduce water pollution	89%	63%	LEED + 26%
Reduce air pollution	70%	70%	TIED
Human Health	**94%**	**100%**	**HDMT + 6%**
Reduce malnutrition	23%	44%	HDMT + 21%
Reduce chronic disease	81%	93%	HDMT + 12%
Reduce infectious disease	21%	48%	HDMT + 27%
Improve mental health	45%	74%	HDMT + 29%
Reduce accidental injury/death	60%	67%	HDMT + 7%
Societal Health	**85%**	**100%**	**HDMT + 15%**
Improve health of the economy	64%	58%	LEED + 6%
Increase environmental justice	79%	100%	HDMT + 21%
Reduce social disorder	32%	78%	HDMT + 46%
Increase social capital	45%	85%	HDMT + 40%

Table 8: Manifest and Latent Content by Goal Topic Expressed as Percentage of Total Credits/Objectives within Each Metric

Within the environmental health goals category, the goals of conserving natural resources and reducing water and air pollution are embedded significantly more throughout both metrics than the goal of conserving species diversity. LEED-ND focuses on environmental goals in approximately 20% more of its credits/objectives than the HDMT does. An interesting exception is that reducing air pollution is applicable to 70% of the credits/objectives in both metrics. Because the HDMT puts a heavy emphasis on reducing chronic diseases, including asthma, air pollution directly plays a much bigger role in our health as a developed country than issues we face with water pollution, natural resources, and species diversity.

Within the human health category, the HDMT focuses on each individual goal topic in 7% to 29% more of its credits than LEED-ND does, but, interestingly, this only applies to each individual goal topic. When all health goal topics are combined, LEED-ND addresses health goals in a remarkable 94% of its credits. This dramatic difference

between the percent of credits addressing each goal topic and the overall human health goal category indicates that, while the HDMT objectives simultaneously have the ability to influence many health outcomes at once, LEED-ND objectives may be applicable to only one or two health outcomes for each credit.

For the societal health category, again the HDMT focuses on each individual goal topic in 21% to 46% more of its credits than LEED-ND does. The notable exception is the goal to improve the health of the economy, where it is mentioned in 6% more of the credits in LEED-ND. Again, this resonates with USGBC's affiliation with the ecological modernization movement, which places heavy emphasis on the relationship between the environment and the economy.

In summary, though each metric tends to contain more manifest and latent content in the goal categories and topics specifically related to the professional fields of the organizations in which they were developed, all goal categories and topics are well represented in both metrics and are definitely shared between the fields. In the final chapter, I will discuss a potential method of capitalizing on these shared goals in the context of the neighborhood planning process.

Chapter 6: Discussion

IMPLEMENTATION

Based on the results of the analysis previously discussed, it is clear that there is substantial overlap in the goals of environmental and public health professionals warranting, if not necessitating, close collaboration between the two fields. The question then is how such collaboration can be successfully integrated into existing neighborhood development workflows. I would suggest that this integration may be easiest if placed within the context of the neighborhood planning process that already exists in most communities. In fact, because neighborhood plans are often structured in a manner similar to LEED-ND and the HDMT, it would be informative to apply the content analysis methodology I developed to neighborhood plans issued by various local governments to determine the extent of overlap and variation in goals between neighborhoods within the same city and between different cities.

When it comes to official collaboration between various departments in the same city, outside government bodies, and private agencies, there can be tremendous legal and logistical hurdles to be overcome. However, in my experience working as the coordinator of the Healthy Environments, Healthy Neighbors initiative for The Steps to a Healthier Austin Program (SHA) within the Austin/Travis County Health and Human Services Department from 2007 to 2008, collaboration with both the Neighborhood Planning and Zoning Department and the Parks and Recreation Department proved to be not only possible, but was welcomed.

To provide some background on neighborhood planning in Austin, the City of Austin adopted the *Austin Tomorrow Comprehensive Plan* in 1979 and then amended it through individual neighborhood plans over the next thirty years (after which the new *Imagine Austin Comprehensive Plan* was adopted in 2012). These neighborhood plans

were meant to support and further the overall goals of the comprehensive plan, while simultaneously addressing the unique concerns of each neighborhood. One of the eight goal topics of the 1979 plan was health and human services, but goals relating to this topic were not regularly featured in the city's neighborhood plans. While some plans did mention access to health clinics, none specifically addressed the strong connection between the built environment and health. As an example, the Upper Boggy Creek Neighborhood Plan included specific objectives to "improve the health and well-being of residents' pets" and "improve the quality of life and well-being of elderly, disabled and low-income residents," but improving the overall health of the general population of the neighborhood was never mentioned and only one of the 114 action items in the plan even related explicitly to citizen health.[139]

To address what we saw as a missed opportunity to integrate knowledge from the public health field into the neighborhood planning process, SHA approached Carol Haywood, the manager of neighborhood planning, about the idea of incorporating our knowledge of the connections between the built environment and public health into the neighborhood planning process. On July 8, 2008, we collaborated with the Neighborhood Planning and Zoning Department to conduct a pilot workshop on public health for residents of the North Lamar Combined Planning Area. A second workshop was held on December 15, 2008 for the Heritage Hills/Windsor Hills Combined Neighborhood Planning Area. During these workshops, residents were presented with local health statistics and an overview of various connections between health and the built environment. They were then asked to identify which elements in a series of example photographs they felt supported or hindered physical activity and healthy nutrition. In the

[139] City of Austin Neighborhood Planning and Zoning Department, *Upper Boggy Creek Neighborhood Plan, The Austin Tomorrow Comprehensive Plan*, 2002.

participatory planning session that followed, residents were asked to identify all of the healthy opportunities within their neighborhood, any barriers that prevented them from taking advantage of these opportunities, and any lack of opportunities they felt needed to be addressed.

As a result of our two workshops, both the North Lamar Combined Planning Area and the Heritage Hills/Windsor Hills Combined Neighborhood Planning Area neighborhood plans included a section titled "Community Health" which contained objectives and recommended actions related to increasing opportunities for physical activity and access to healthy nutrition.[140,141] While featuring a health-based section in neighborhood plans marks a small step forward towards recognizing the role of the public health field in neighborhood planning, it does not yet represent the level of integration for which I am arguing, because the implications of the plan on public health were only considered for a single section, even though the majority of items in the plan are likely to have implications on public health.

Based on my experience, I found that various departments were amenable to collaborating when offered assistance. My concern is that, due to their prior training and affiliations with social groups of like-minded colleagues, many professionals in typical planning, environmental, and health departments may not even be aware of the potential connections between their work, limiting their ability to advocate for and seek out such collaboration. In fact, Peterson elaborates on these missed opportunities as they relate to sustainable community frameworks:

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[140] City of Austin Neighborhood Planning and Zoning Department, *The North Lamar Combined Neighborhood Planning Area Neighborhood Plan, The Austin Tomorrow Comprehensive Plan*, 2010, ftp://ftp.ci.austin.tx.us/npzd/Austingo/nlamar-combined-np.pdf.

[141] City of Austin Neighborhood Planning and Zoning Department, *The Heritage Hills/Windsor Hills Combined Neighborhood Plan, The Austin Tomorrow Comprehensive Plan*, 2011, ftp://ftp.ci.austin.tx.us/npzd/heritage_hills_windsor_hills/hhwh_final_plan_011311.pdf.

> The vast diversity in framework structure and focus makes it very difficult to compare the progress of one locality to another, and misses the opportunity to leverage change and share lessons learned.
>
> While frameworks may contain commonalities in terms of verbiage used and apparent themes addressed, these terms and themes do not share common definitions, leading to additional potential confusion and lost opportunities for collaboration.[142]

Even if a municipality is fortunate enough to have a few knowledgeable and passionate people to spearhead interdisciplinary efforts, there are inevitable costs to maintaining the resources required for collaboration based on a framework such as LEED-ND or the HDMT. Establishing a national framework would be one way to potentially save finances and human resources over having each municipality go through the process of establishing their own sustainable community framework independently. Based on interviews, Peterson says staff of various sustainable community frameworks expressed interest in the development of a national framework, so long as it "was created in a participatory, peer-reviewed fashion with flexibility to accommodate the priority issues of a particular locale."[143] Further, he explains that "a national framework should recognize the need and design to facilitate this local ownership. A framework is best served by robust linkages to those entities responsible for implementation, and by connections between indicators used to measure sustainability and government performance measures."[144]

Ultimately, establishing a national framework, such as LEED-ND or the HDMT, represents a tremendous amount of work, but Peterson points out that basing a sustainable community framework on "commonly agreed upon principles […will] provide a basis on

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[142] Peterson, "A Comparative Analysis of Sustainable Community Frameworks," 3.

[143] Ibid.

[144] Ibid.

which stakeholders with differing interests and viewpoints can come together in pursuit of common ends."[145] I hope that by conducting the type of quantitative analysis of commonly agreed upon principles and goals between multiple fields, such as I have done in this study, and merging those commonalities into a single framework, momentum can be built through the involvement of a greater number of interest groups who bring with them a greater amount of manpower and funding to actually implement their shared goals. The process of identifying common values and goals will also inevitably provide the opportunity to actively acknowledge differences and seek out compromises. The process of working through these differences in values is often what leads to some of the most significant societal changes.

METRIC DEVELOPMENT

While completing this thesis over an extended period of time has proved challenging due to the constantly changing nature of the fields and their respective metrics, it has also been incredibly rewarding in that evidence of some of the interdisciplinary collaboration and recognition of shared goals for which I am advocating has become apparent in revisions of both sets of metrics. Though outside of the scope of this paper, it would be interesting to repeat the content analysis for each version of each metric to measure shifts between latent and manifest content related to goal categories in both fields over time. It would also be interesting to conduct an ethnographic study amongst those involved in the creation of the metrics to learn the processes behind how such shifts came about and to determine how such practices can be implemented elsewhere to encourage widespread collaboration. I did not conduct a formal longitudinal content analysis or detailed ethnographic study, but would like to end the paper by

[145] Ibid., 4.

sharing some preliminary observations, as I believe they shed light on the future trajectory of explicit recognition of interdisciplinary goals within neighborhood sustainability frameworks.

LEED for Neighborhood Development

The Pilot version of LEED-ND was released in 2007, followed by the Public Comment Draft in 2008. The first official version was released as part of the major LEED 2009 revision of all of USGBC's LEED metrics. In addition, new versions of LEED-ND with minor corrections have been released once or twice per year since its inception.

Between the Pilot and the Public Comment Draft, there was a significant shift in LEED-ND towards the explicit inclusion of health. In the Pilot Version, the only credit explicitly mentioning health was *SLL Credit 7: School Proximity*, which was subsequently removed altogether.[146] Remarkably in contrast, the Public Comment Draft explicitly mentioned the potential effects on human health in the intents of eighteen credits and objectives. As an example of this major transition, the written intent of *SLL Prerequisite 1: Smart Location* in the Pilot was to:

> Encourage development within and near existing communities or public transportation infrastructure. Reduce vehicle trips and miles traveled and support walking as a transportation choice.[147]

In the Pilot, many of the credits placed an emphasis on efficiency for efficiency's sake, with no mention of the specific benefits that gains in efficiency could have on environmental or human health. In the Public Comment Draft, the following text was added to the end of the written intent:

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[146] *LEED for Neighborhood Development Rating System*, 1st Public Comment Draft Track Change from Pilot (Washington, DC: U.S. Green Building Council, October 31, 2008), 31.

[147] *LEED for Neighborhood Development Rating System*, Pilot Version (Washington, DC: U.S. Green Building Council, 2007), 1.

> Reduce the risk of obesity, heart disease, and hypertension by encouraging daily physical activity associated with alternative modes of transportation and compact development. Improve the mental health of the community by reducing work commute time and increasing time devoted to leisure, community activities and family.[148]

Another common sentence that was added to the end of the written intent for several credits was:

> Reduce public health impacts associated with sprawl, such as asthma, respiratory diseases, and injuries from motor vehicles.[149]

Such a major addition of health-specific content represents a landmark moment in the conscious collaboration between the two fields. The final version of the written intent for *SLL Prerequisite 1: Smart Location* in LEED 2009 was modified to say:

> To encourage development within and near existing communities and public transit infrastructure. To encourage improvement and redevelopment of existing cities, suburbs, and towns while limiting the expansion of the development footprint in the region to appropriate circumstances. To reduce vehicle trips and vehicle miles traveled (VMT). To reduce the incidence of obesity, heart disease, and hypertension by encouraging daily physical activity associated with walking and bicycling.[150]

It is interesting that while the implications of the prerequisite on physical chronic diseases were left in the final version, the effects on mental health were ultimately removed. Also interesting is that in the credits for which a health goal and mechanism was added, those health-related components were very clearly elucidated, while the environmental goals were often taken for granted. For example, in the LEED 2009 intent listed above, it is clear that the intent is to encourage compact development (action) to reduce VMT and encourage physical activity (mechanism) to reduce the incidence of

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[148] *LEED for Neighborhood Development Rating System*, 1.

[149] Ibid., 24.

[150] Congress for the New Urbanism, Natural Resources Defense Council, and U.S. Green Building Council, "LEED 2009 for Neighborhood Development Rating System."

chronic disease (goal). In this case, the human health goal of reducing the incidence of chronic disease is explicitly stated, but the corresponding environmental goal of reducing air and water pollution is not. It seems that the momentum for including public health in the credit intents was so effective that it ultimately ended up overshadowing the original environmental goals in some cases.

The Healthy Development Measurement Tool

Just as LEED-ND began to incorporate public health, the HDMT began to directly reference LEED rating systems. Between November 2007 and June 2012, four major versions and one minor version of the HDMT were released. For objectives *ES.1.a* and *ES.1.b*, which relate to decreasing consumption of natural gas and electricity, Version 1.01 of the HDMT lists the following benchmark:

> Is the project Green Point Rated at 35% above California Energy Commission Title 24 energy efficiency standards?[151]

In comparison, the benchmarks listed in Version 2.01 of the HDMT are as follows:

> If the project is a new mid-size multi-family or new small residential (1-4 units) project, does it achieve 40 points or more in the energy section of the Green Point Rated checklist? If the project is a mid-size commercial project (new or alteration), large commercial tenant improvement or major alternation, new high-rise residential, or new large commercial project, does it earn 8 points in the "Energy and Atmosphere Credit 1: Optimize Energy Performance" under the LEED checklist?[152]

As becomes evident, one of the most notable changes in the HDMT, has been the explicit inclusion of references to LEED standards for large projects. To keep up with the

[151] San Francisco Department of Public Health, "HDMT Development Checklist Version 1.01", November 2007, http://www.sustainablesf.org/etc/HDMT_Development_Checklist_Nov.07.Version.1.01.pdf.

[152] San Francisco Department of Public Health, "HDMT Development Checklist Version 2.01", April 2008, http://www.sustainablesf.org/etc/HDMT_Development_Checklist_April_2008_Version_2.01.pdf.

development of LEED, Version 3.01 modified the requirements for large projects as follows:

> Does it earn 2 or more points in the "Energy and Atmosphere" Section under the LEED 2.2 checklist?[153]

By Version 4.02, released five years after the initial version, the integration of LEED has become so ingrained in the HDMT that the particular credits or sections of LEED relevant to the objective of decreasing energy use are no longer specified. Instead, there is a blanket requirement that the project must achieve a particular LEED certification level as follows:

> If the project is a residential project (5+ units), does the project meet LEED Silver or an equivalent third-party certification standard OR If the project is a commercial or institution project, does the project meet LEED Gold or an equivalent third-party certification standard?[154]

These changes represent a shift towards greater multi-framework integration.

In September 2012, after the majority of the research in this thesis had been completed, SFDPH went even further and rebranded the HDMT as the Sustainable Communities Index (SCI). I believe this fundamental transformation is an indication that the organization is shifting away from focusing solely on the topic of public health in isolation. By replacing the term "healthy" with the term "sustainable", SFPDH may be trying to reach out to a much wider audience than just public health professionals. Also interesting is it appears that SFPDH is transforming the tool from an indicators initiative framework into a ranking project framework, based on their description that, "the SCI

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[153] San Francisco Department of Public Health, "HDMT Development Checklist - Version 3.01", September 2009, http://www.sustainablesf.org/etc/HDMT_Development_Checklist_September_2009_Version_3.01.pdf.

[154] San Francisco Department of Public Health, "HDMT Development Checklist Version 4.02", June 2012, http://www.sustainablesf.org/etc/HDMT_Development_Checklist_June_2012_Version_4.02_final.pdf.

still has all of the great local data that the HDMT was known for, but is now focused more on serving as a health and sustainability performance measurement system for the City of San Francisco, rather than a tool for evaluating discrete development projects."[155] While the original HDMT materials are still available on their website, it seems that the SCI is no longer targeting HIA-based project-level evaluations.

If SCI is successfully able to incorporate the prior HDMT neighborhood development project indicator initiative framework with a city-level ranking project framework into one comprehensive system, it would represent a major step forward towards integrating multiple framework scales and types. On the other hand, if the ability to evaluate the potential impacts of individual projects is no longer supported and completely replaced with city indicators, I believe it is a step backwards. Simply monitoring present city-wide conditions is not as proactive as preemptively assessing the direction of future development towards or away from desired objectives.

Another interesting component of the SCI program, implemented at roughly the same time as the rebranding effort, is providing online access to the data used in both the HDMT evaluations and other programs within the Environmental Health Section of the SFDPH. In the analysis in the previous chapter, I mentioned that the HDMT was already proactive about posting their data in tabular and map form online. They are further increasing access by providing data through the City's data portal, called *DataSF*.

> Environmental Health will provide access to city baseline and neighborhood data which can help visualize complex changes in the social, economic and physical environments most important to health and land use. The goal of the open data initiative is to make our community more informed, connected and create citizen innovation through government.

[155] Sustainable Communities Index, "Sustainable Communities Index", 2012, http://www.sustainablesf.org/.

> Increasing access to data helps the City explore new solutions, improve government efficiency and support civic engagement. It also allows the private sector to creatively apply open data to technological innovations that improve the quality of life. Environmental Health is committed to making data on city and government performance publicly available and is currently working on several projects to meet this goal.[156]

While providing access to community data facilitates collaboration and shared understanding, there is still the great obstacle of how best to collect such data for other communities in the first place.

It is obvious from this overview of the development of both metrics that they are still actively being developed and revised. While they are currently voluntary, they are also increasingly being implemented and incorporated into various local and national regulatory frameworks. I would argue it is at this very moment in time that these codes have the greatest potential to have a widespread impact, while simultaneously remaining flexible enough to address local conditions and values. Based on the theory of technological determinism, Hughes explains that the development and use of a relatively new technology (in this case, the sustainable neighborhood metrics) can be easily shaped by society, but as the technology matures and becomes entrenched in the political, economic, and value systems of society, it becomes increasingly difficult, though not impossible, to change its trajectory.[157] In other words, it is likely that once the codes become mandatory nationwide, they will become considerably more difficult to rapidly overhaul in response to changing conditions. The frequency with which new versions of both metrics are released and the great number of significant changes between versions

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[156] Program on Health, Equity and Sustainability, San Francisco Department of Public Health, "Health Data," *Program on Health, Equity and Sustainability, San Francisco Department of Public Health*, n.d., http://www.sfphes.org/resources/health-data.

[157] Thomas Hughes, "Technological Momentum," in *Does Technology Drive History: The Dilemma of Technological Determinism*, ed. Merritt Roe Smith and Leo Marx (Cambridge, MA: MIT Press, 1994), 101–114.

indicates that, despite increasing popularity, they currently remain flexible enough to accommodate increasing levels of interdisciplinary collaboration.

At this point, there is evidence of significant momentum behind the processes shaping sustainable neighborhood codes. My thesis has demonstrated that, while both fields already recognize that a small portion of their goals are shared, it is actually likely that nearly all of their goals are shared. I believe at this time of simultaneous momentum and flexibility, it is critical to actively acknowledge these shared goals, so that both fields may benefit from the greater amount of support, resources, and expertise that would become available to them through collaboration. In addition to integrating shared goals into our sustainable neighborhood codes, it will be important to do further research and experimentation into how these codes can best be modified and implemented by local governments throughout the country.

Appendix A: Content Analysis Codebook for Sustainability Metrics

Unit of Data Collection: Each individual credit/objective in the metric.

Credit/Objective ID: Fill in the full name of the credit/objective as listed in the metric.

Action: Indicate whether or not an action is explicitly mentioned in the credit/objective relating to each of the three goal categories: environmental health, human health, and societal health.

> *1 – Manifest:* An action with the stated or known potential to impact the goal category through a particular mechanism is explicitly mentioned in the text.
>
> *-1 – Latent:* An action with the stated or known potential to impact the goal category through a particular mechanism is not explicitly mentioned in the text, but a mechanism and/or a goal related to that goal category is explicitly mentioned in the text and you are aware of a potential action that would help achieve the stated mechanism and/or goal.
>
> *0 – Absent:* An action with the stated or known potential to impact the goal category through a particular mechanism is not explicitly mentioned in the text and neither is a mechanism nor goal explicitly mentioned in the text that relate to the goal category.

Mechanism: Indicate whether or not a mechanism is explicitly mentioned in the credit/objective relating to each of the three goal categories: environmental health, human health, and societal health.

> *1 – Manifest:* A mechanism resulting in the goal category due to a particular action is explicitly mentioned in the text.
>
> *-1 – Latent:* A mechanism resulting in the goal category due to a particular action is not explicitly mentioned in the text, but an action and/or goal related to that goal category are explicitly mentioned in the text and you are aware of a hypothesized or proven mechanism which links to the manifest action or goal within that goal category.

0 – Absent: A mechanism resulting in the goal category due to a particular action is not explicitly mentioned in the text and neither is an action nor goal explicitly mentioned in the text that relate to the goal category.

Goal: Indicate whether or not a root-level goal is explicitly mentioned in the credit/objective relating to each of the three goal categories: environmental health, human health, and societal health.

1 – Manifest: A root-level goal related the goal category is explicitly mentioned in the text.

-1 – Latent: A root-level goal related to the goal category is not explicitly mentioned in the text, but an action and/or mechanism which you know to result in the goal category are explicitly mentioned in the text.

0 – Absent: A root-level goal related to the goal category is not explicitly mentioned in text and neither is an action nor mechanism explicitly mentioned in the text that relate to the goal category.

Goal Topic: Indicate whether or not all three metric components (action, mechanism, and goal) are explicitly mentioned in the credit/objective for each of the thirteen goal topics across the three goal categories as listed below.

1 – Manifest: An action, mechanism, and goal related to the particular root-level goal topic are all explicitly mentioned in the text.

-1 – Latent: At least one, but not all, of the three metric components (action, mechanism, and goal) related to the particular root-level goal topic is explicitly mentioned in the text.

0 – Absent: No actions, mechanisms, or goals related to the particular root-level goal topic are explicitly mentioned in text.

Environmental Health Category Goal Topics

- Preserve the diversity of plant and animal species.
- Conserve natural resources, such as fossil fuels.
- Reduce water pollution and improve water quality.
- Reduce air pollution and improve air quality.

Human Health Category Goal Topics

- Reduce the incidence of malnutrition and starvation.

- Reduce the incidence, severity, and mortality of chronic diseases, including heart disease, stroke, cancer, diabetes, obesity, chronic lower respiratory diseases, and arthritis.

- Reduce the incidence and mortality of infectious diseases, including waterborne and foodborne diseases.

- Reduce the incidence, severity, and mortality of mental illness and stress.

- Reduce the incidence of accidental injuries and death.

Societal Health Category Goal Topics

- Improve the health of the economy.

- Increase environmental justice so that a distinct portion of the population does not bear an inequitable burden of the environmental and human health costs associated with development and economic prosperity.

- Reduce crime and social disorder, including physical abuse, drug and alcohol abuse, and other behavioral problems.

- Increase access to cultural amenities; improve academic outcomes; and increase social capital, which includes civic participation, social cohesion, social interaction, and community building.

Appendix B: Mission Statements

LEED-ND ORGANIZATIONS

U.S. Green Building Council's Mission[158]

To transform the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy, and prosperous environment that improves the quality of life.

U.S. Green Building Council's Vision[159]

Buildings and communities will regenerate and sustain the health and vitality of all life within a generation.

U.S. Green Building Council's Preamble[160]

Whereas USGBC is dedicated to improving conditions for humanity and nature, honoring and enhancing the prospects for both through the creation of a built environment that is mutually beneficial, we hereby acknowledge our allegiance to these essential values:

Sustainability: Respect the limits of natural systems and non-renewable resources by seeking solutions that produce an abundance of natural and social capital.

Equity: Respect all communities and cultures and aspire to an equal socio-economic opportunity for all.

Inclusiveness: Practice and promote openness, broad participation and full consideration of consequence in all aspects of decision-making processes.

Progress: Strive for immediate and measureable indicators of environmental, social and economic prosperity.

Connectedness: Recognize the critical linkage between humanity and nature as well as the importance of place-based decision-making to effective stewardship.

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[158] U.S. Green Building Council, "About USGBC."

[159] Ibid.

[160] U.S. Green Building Council, "USGBC Guiding Principles."

U.S. Green Building Council's Guiding Principles[161]

> **Promote the Triple Bottom Line:** USGBC will pursue robust triple bottom line solutions that clarify and strengthen a healthy and dynamic balance between environmental, social and economic prosperity.
>
> **Establish Leadership:** USGBC will take responsibility for both revolutionary and evolutionary leadership by championing societal models that achieve a more robust triple bottom line.
>
> **Reconcile Humanity with Nature:** USGBC will endeavor to create and restore harmony between human activities and natural systems.
>
> **Maintain Integrity:** USGBC will be guided by the precautionary principle in utilizing technical and scientific data to protect, preserve and restore the health of the global environment, ecosystems and species.
>
> **Ensure Inclusiveness:** USGBC will ensure inclusive, interdisciplinary, democratic decision-making with the objective of building understanding and shared commitments toward a greater common good.
>
> **Exhibit Transparency:** USGBC shall strive for honesty, openness and transparency.
>
> **Foster Social Equity:** USGBC will respect all communities and cultures and aspire to an equal opportunity for all.

Congress for the New Urbanism's Mission[162]

> As outlined in the preamble to our Charter, CNU advocates the restructuring of public policy and development practices to support the restoration of existing urban centers and towns within coherent metropolitan regions. We stand for the reconfiguration of sprawling suburbs into communities of real neighborhoods and diverse districts, the conservation of natural environments, and the preservation of our built legacy.
>
> Rebuilding neighborhoods, cities, and regions is profoundly interdisciplinary. We believe that community, economics, environment, health and design need to be addressed simultaneously through urban design and planning.

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[161] Ibid.

[162] Congress for the New Urbanism, "CNU History."

Natural Resources Defense Council's Mission[163]

> The Natural Resources Defense Council's purpose is to safeguard the Earth: its people, its plants and animals and the natural systems on which all life depends.
>
> We work to restore the integrity of the elements that sustain life – air, land and water – and to defend endangered natural places.
>
> We seek to establish sustainability and good stewardship of the Earth as central ethical imperatives of human society. NRDC affirms the integral place of human beings in the environment.
>
> We strive to protect nature in ways that advance the long-term welfare of present and future generations.
>
> We work to foster the fundamental right of all people to have a voice in decisions that affect their environment. We seek to break down the pattern of disproportionate environmental burdens borne by people of color and others who face social or economic inequalities. Ultimately, NRDC strives to help create a new way of life for humankind, one that can be sustained indefinitely without fouling or depleting the resources that support all life on Earth.

LEED Mission[164]

> LEED encourages and accelerates global adoption of sustainable and green building and neighborhood development practices through the creation and implementation of a universally understood and accepted benchmark encompassing existing and new standards, tools, and performance criteria.

LEED Strategic Goals[165]

> The LEED Green Building Rating System will strive to:
>
> Promote the tangible and intangible benefits of green buildings, including environmental, economic, human health, and social benefits over the life cycle of buildings.
>
> Achieve high profile and successful product launches.

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[163] Natural Resources Defense Council, "About NRDC: Mission Statement."

[164] U.S. Green Building Council, "Foundations of LEED," 3.

[165] Ibid., 4.

Earn widespread and routine endorsement by private and public real estate industry leaders and stakeholders.

Earn widespread and routine endorsement by Federal, State, and Local Government and adoption as a vehicle for policy development and implementation.

Deliver superior customer service that is professional, timely, and targeted to the customer's needs.

Offer a comprehensive portfolio of programs to meet the diverse needs of the real estate industry.

Develop innovative technical tools and support services for LEED products.

To consolidate LEED as the standard for green building practices for our homes, nonresidential buildings, and developments throughout the U.S.

To support International adaptations of LEED with interested international organizations, such as green building councils.

Lead the industry state of knowledge about practical implementation of the most up-to-date and practical innovations.

Improve LEED performance criteria as the industry gains experience with integrated design, green construction, and sustainable operations and maintenance.

HDMT ORGANIZATIONS

San Francisco Department of Public Health Mission[166]

The Mission of the San Francisco Department of Public Health is to protect and promote the health of all San Franciscans.

The San Francisco Department of Public Health shall:

- Assess and research the health of the community
- Develop and enforce health policy
- Prevent disease and injury

[166] San Francisco Department of Public Health, *San Francisco Department of Public Health 2009-2010 Annual Report*, 2.

- Educate the public and train health care providers
- Provide quality, comprehensive, culturally-proficient health services
- Ensure equal access to all.

Environmental Health Section Mission[167]

> The San Francisco Department of Public Health strives to protect and improve health and quality of life for all San Franciscans by improving the environmental quality where they live, work and play. Environmental Health advances this mission by implementing San Francisco's health-protective environmental policies and laws. Our work ensures: safe and nutritious food; protection from excessive noise; prevention of exposure to chemicals, polluted soil, air and water; habitable housing; and quality neighborhoods.

Program on Health, Equity and Sustainability's Mission[168]

> The Program on Health, Equity and Sustainability supports San Franciscans working together to advance urban health and social and environmental justice through ongoing integration of local government and community efforts and through valuing the needs, experiences, and knowledge of diverse San Francisco residents. We accomplish this by:
>
> Initiating and facilitating dialogue and collaboration among public agencies and community organizations
>
> Expanding public understanding of the relationships between the natural, built, and social environments and human health
>
> Support local participation in public policy-making
>
> Conducting and supporting local and regional research
>
> Developing and evaluating new methods for interdisciplinary and inclusive involvement in public-policy
>
> Documenting and communicating our strategies

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[167] San Francisco Department of Public Health, "Environmental Health."

[168] Department of Public Health, City and County of San Francisco, "Program on Health Equity and Sustainability Mission."

In our vision of San Francisco, communities are engaged in democracy and committed to equality and diversity. We believe this will create and maintain sustainable and healthy places for all San Franciscans to live, work, learn, and play.

Program on Health, Equity and Sustainability's Guiding Principles and Core Values[169]

Healthful Environments Healthy People reflect healthful environments. Following the 1986 WHO Charter on Health Promotion, we define the basic conditions and resources needed for health to be peace, shelter, education, food, income, stable ecosystems, sustainable resources, social justice, and equity.

Equity A fair distribution of economic, political, social and natural resources and opportunities improves individual livelihood and the overall health of society.

Sustainability Conserving and improving economic, social and environmental systems so that present and future community members can lead healthy, productive and enjoyable lives.

Inter-connectedness The natural and built environments, human activities, and human relationships are connected.

Public Access and Accountability The process for making public choices must be open and involve the people most affected. Good public policy decisions ensures that all participants have access to relevant information, including an understanding of underlying conflicts and competing interests.

Meaningful participation Ensuring meaningful public participation in policy-making requires sincere actions to support people's involvement, the valuing of local knowledge and experiences, and incorporating the perspectives and needs of communities into decision-making.

Urban Health and Place Team's Description[170]

Public health is not just about healthcare, but also about shaping policy decisions so that they create healthier, more equitable communities in which people live, learn, work and play. The place where people live, how communities are planned and built, and the types of access and services provided within them, directly impacts health. Developing land use planning policies and practices that promote

[169] Ibid.

[170] San Francisco Department of Public Health, "Urban Health & Place."

health and well-being is integral for health promotion, prevention and reducing health disparities.

Using this aforementioned framework, the Urban Health and Place Team within the Program on Health, Equity and Sustainability develops, applies and disseminates spatial tools, research and expertise to assess environmental conditions and respond to urban health inequities and environmental policy gaps. We assess many elements of the built environment including: land use, transportation, housing, water, air quality, noise quality, climate, and other aspects of health.

With a focus on San Francisco, we use health impact assessment tools and our general public health expertise to work with community stakeholders and government agencies to inform project development and decision-making to promote healthy environments and address health inequities in public policy. We believe the design of the built environment is critical to urban health and are dedicated to working with other local city agencies, community-based organizations, state and federal partners to provide technical assistance and analysis and innovative policy solutions to end chronic health conditions through the design of our City.

Appendix C: Content Analysis Data

The full coded results of the content analysis are presented in the tables that follow. In order to fit within the space of a single page, the full credit and objective names were removed from the tables, but are included in their entirety below for the purposes of cross-referencing.

Table 9: LEED-ND Credit and HDMT Objective Names

LEED-ND: SMART LOCATION & LINKAGE
SLL Prerequisite 1: Smart Location
SLL Prerequisite 2: Imperiled Species and Ecological Communities Conservation
SLL Prerequisite 3: Wetland and Water Body Conservation
SLL Prerequisite 4: Agricultural Land Conservation
SLL Prerequisite 5: Floodplain Avoidance
SLL Credit 1: Preferred Locations
SLL Credit 2: Brownfields Redevelopment
SLL Credit 3: Locations with Reduced Automobile Dependence
SLL Credit 4: Bicycle Network and Storage
SLL Credit 5: Housing and Jobs Proximity
SLL Credit 6: Steep Slope Protection
SLL Credit 7: Site Design for Habitat or Wetland and Water Body Conservation
SLL Credit 8: Restoration of Habitat or Wetlands and Water Bodies
SLL Credit 9: Long-Term Conservation Management of Habitat or Wetlands and Water Bodies
LEED-ND: NEIGHBORHOOD PATTERN & DESIGN
NPD Prerequisite 1: Walkable Streets
NPD Prerequisite 2: Compact Development
NPD Prerequisite 3: Connected and Open Community
NPD Credit 1: Walkable Streets
NPD Credit 2: Compact Development
NPD Credit 3: Mixed-Use Neighborhood Centers
NPD Credit 4: Mixed-Income Diverse Communities
NPD Credit 5: Reduced Parking Footprint
NPD Credit 6: Street Network
NPD Credit 7: Transit Facilities
NPD Credit 8: Transportation Demand Management
NPD Credit 9: Access to Civic and Public Spaces
NPD Credit 10: Access to Recreation Facilities

NPD Credit 11: Visitability and Universal Design
NPD Credit 12: Community Outreach and Involvement
NPD Credit 13: Local Food Production
NPD Credit 14: Tree-Lined and Shaded Streets
NPD Credit 15: Neighborhood Schools
LEED-ND: GREEN INFRASTRUCTURE AND BUILDINGS
GIB Prerequisite 1: Certified Green Building
GIB Prerequisite 2: Minimum Building Energy Efficiency
GIB Prerequisite 3: Minimum Building Water Efficiency
GIB Prerequisite 4: Construction Activity Pollution Prevention
GIB Credit 1: Certified Green Buildings
GIB Credit 2: Building Energy Efficiency
GIB Credit 3: Building Water Efficiency
GIB Credit 4: Water Efficient Landscaping
GIB Credit 5: Existing Building Reuse
GIB Credit 6: Historic Building Preservation and Adaptive Use
GIB Credit 7: Minimize Site Disturbance in Design and Construction
GIB Credit 8: Stormwater Management
GIB Credit 9: Heat Island Reduction
GIB Credit 10: Solar Orientation
GIB Credit 11: On-Site Renewable Energy Sources
GIB Credit 12: District Heating and Cooling
GIB Credit 13: infrastructure Energy Efficiency
GIB Credit 14: Wastewater Management
GIB Credit 15: Recycled Content in Infrastructure
GIB Credit 16: Solid Waste Management Infrastructure
GIB Credit 17: Light Pollution Reduction
LEED-ND: INNOVATION AND DESIGN PROCESS (Not included in content analysis)
IDP Credit 1: Innovation and Exemplary Performance
IDP Credit 2: LEED Accredited Professional
REGIONAL PRIORITY CREDIT (Not included in content analysis)
RP Credit 1: Regional Priority Credit
HDMT: ENVIRONMENTAL STEWARDSHIP
Objective ES.1 Decrease consumption of energy and natural resources
Objective ES.2 Restore, preserve and protect healthy natural habitats
Objective ES.3 Reduce residential and industrial conflicts
Objective ES.4 Preserve clean air quality
Objective ES.5 Maintain safe levels of community noise
HDMT: SUSTAINABLE AND SAFE TRANSPORTATION
Objective ST.1 Decrease private motor vehicles trips and miles traveled

Objective ST.2 Provide affordable and accessible public transportation options

ObjectiveST.3 Create safe, quality environments for walking and biking

HDMT: SOCIAL COHESION

Objective SC.1 Promote socially cohesive neighborhoods, free of crime and violence

Objective SC.2 Increase civic, social, and community engagement

Objective SC.3 Assure equitable and democratic participation throughout the planning process

HDMT: PUBLIC INFRASTRUCTURE/ACCESS TO GOODS AND SERVICES

Objective PI.1 Assure affordable and high quality child care for all neighborhoods

Objective PI.2 Assure accessible and high quality educational facilities

Objective PI.3 Assure spaces for libraries, performing arts, theatre, museums, concerts, and festivals for personal and educational fulfillment

Objective PI.4 Assure affordable and high quality public health facilities

Objective PI.5 Increase park, open space and recreation facilities

Objective PI.6 Increase accessibility, beauty, safety, and cleanliness of public spaces

Objective PI.7 Assure access to daily goods and service needs

Objective PI.8 Promote affordable and high-quality food access and sustainable agriculture

HDMT: ADEQUATE AND HEALTHY HOUSING

Objective HH.1 Preserve and construct housing in proportion to demand with regards to size, affordability, and tenure

Objective HH.2 Protect residents from involuntary displacement

Objective HH.3 Decrease concentrated poverty

Objective HH.4 Assure access to healthy quality housing

HDMT: HEALTHY ECONOMY

Objective HE.1 Increase high-quality employment opportunities for local residents

Objective HE.2 Increase jobs that provide healthy, safe and meaningful work

Objective HE.3 increase equality in income and wealth

Objective HE.4 Protects and enhances natural resources and the environment

Table 10: Content Analysis for LEED-ND Prerequisites and Credits in the Smart Location and Linkage Category

		SLL Prerequisite 1	SLL Prerequisite 2	SLL Prerequisite 3	SLL Prerequisite 4	SLL Prerequisite 5	SLL Credit 1	SLL Credit 2	SLL Credit 3	SLL Credit 4	SLL Credit 5	SLL Credit 6	SLL Credit 7	SLL Credit 8	SLL Credit 9
ENVIRO. HEALTH	Action	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Mechanism	1	1	-1	1	-1	-1	1	1	1	-1	1	1	1	1
	Goal	-1	1	1	1	1	1	1	1	-1	-1	1	1	1	1
Goal Topic	Species diversity	-1	1	1	-1	0	-1	-1	0	0	0	1	1	1	1
	Natural resources	-1	0	0	1	1	1	1	-1	-1	-1	0	0	0	0
	Water pollution	-1	0	1	0	1	-1	-1	-1	-1	-1	1	1	1	1
	Air pollution	-1	0	0	0	0	-1	-1	1	-1	-1	0	0	0	0
HUMAN HEALTH	Action	1	0	1	1	1	1	1	1	1	1	1	1	1	1
	Mechanism	1	0	1	-1	-1	-1	-1	1	1	-1	1	1	1	1
	Goal	1	0	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Goal Topic	Malnutrition	0	0	0	-1	0	0	0	0	0	0	-1	0	0	0
	Chronic disease	1	0	-1	-1	0	-1	-1	-1	-1	-1	0	-1	-1	-1
	Infectious disease	0	0	-1	-1	0	0	0	0	0	0	0	-1	-1	-1
	Mental health	0	0	0	0	0	0	0	-1	-1	-1	0	0	0	0
	Accidental injury	-1	0	0	0	1	-1	-1	-1	-1	-1	0	0	0	0
SOCIAL HEALTH	Action	1	0	0	1	1	1	1	1	1	1	0	0	0	0
	Mechanism	-1	0	0	1	-1	-1	-1	-1	-1	-1	0	0	0	0
	Goal	-1	0	0	-1	-1	1	-1	-1	-1	-1	0	0	0	0
Goal Topic	Economy	-1	0	0	-1	-1	1	-1	0	0	-1	0	0	0	0
	Environmental justice	-1	0	0	0	-1	-1	-1	-1	-1	-1	0	0	0	0
	Crime	-1	0	0	0	0	-1	-1	0	0	0	0	0	0	0
	Social capital	-1	0	0	0	0	-1	-1	-1	0	0	0	0	0	0

Table 11: Content Analysis for LEED-ND Prerequisites and Credits in the Neighborhood Pattern and Design Category

		NPD Prerequisite 1	NPD Prerequisite 2	NPD Prerequisite 3	NPD Credit 1	NPD Credit 2	NPD Credit 3	NPD Credit 4	NPD Credit 5	NPD Credit 6
ENVIRO. HEALTH	Action	1	1	1	1	1	1	0	1	1
	Mechanism	1	1	1	1	1	1	0	-1	1
	Goal	-1	1	-1	-1	1	-1	0	-1	1
Goal Topic	Species diversity	0	0	0	0	1	0	0	0	0
	Natural resources	-1	1	-1	-1	1	-1	0	-1	1
	Water pollution	-1	-1	-1	-1	-1	-1	0	-1	-1
	Air pollution	-1	-1	-1	-1	-1	-1	0	-1	1
HUMAN HEALTH	Action	1	1	1	1	1	1	0	1	1
	Mechanism	1	1	1	1	1	1	0	1	1
	Goal	1	1	1	1	1	-1	0	1	1
Goal Topic	Malnutrition	0	0	0	0	0	-1	0	0	0
	Chronic disease	1	1	1	1	1	-1	0	1	1
	Infectious disease	0	0	0	0	0	0	0	0	0
	Mental health	-1	-1	-1	-1	-1	-1	0	-1	-1
	Accidental injury	1	-1	-1	1	-1	-1	0	-1	-1
SOCIAL HEALTH	Action	1	1	1	1	1	1	1	0	1
	Mechanism	1	1	1	1	1	1	1	0	-1
	Goal	-1	-1	-1	-1	-1	-1	1	0	-1
Goal Topic	Economy	0	-1	0	0	-1	0	1	0	0
	Environmental justice	-1	-1	-1	-1	-1	-1	1	0	-1
	Crime	-1	-1	-1	-1	-1	-1	0	0	0
	Social capital	-1	-1	-1	-1	-1	-1	1	0	-1

Table 12: Content Analysis for LEED-ND Prerequisites and Credits in the Neighborhood Pattern and Design Category Continued

		NPD Credit 7	NPD Credit 8	NPD Credit 9	NPD Credit 10	NPD Credit 11	NPD Credit 12	NPD Credit 13	NPD Credit 14	NPD Credit 15
ENVIRO. HEALTH	Action	1	1	1	0	0	1	1	1	1
	Mechanism	1	1	-1	0	0	-1	-1	1	-1
	Goal	-1	1	-1	0	0	-1	-1	1	-1
Goal Topic	Species diversity	0	0	0	0	0	-1	-1	-1	0
	Natural resources	-1	1	0	0	0	-1	-1	-1	-1
	Water pollution	-1	1	-1	0	0	-1	-1	-1	-1
	Air pollution	-1	1	-1	0	0	-1	-1	1	-1
HUMAN HEALTH	Action	1	1	1	1	1	1	1	1	1
	Mechanism	1	1	1	1	1	-1	1	1	1
	Goal	-1	-1	1	1	-1	-1	1	-1	1
Goal Topic	Malnutrition	0	0	0	0	0	-1	1	0	-1
	Chronic disease	-1	-1	1	1	0	-1	-1	-1	1
	Infectious disease	0	0	0	0	0	-1	-1	-1	0
	Mental health	-1	-1	1	1	-1	-1	0	-1	-1
	Accidental injury	-1	-1	0	0	-1	-1	0	-1	-1
SOCIAL HEALTH	Action	1	1	1	1	1	1	1	1	1
	Mechanism	1	-1	1	1	1	1	1	1	1
	Goal	-1	-1	1	1	1	-1	1	-1	1
Goal Topic	Economy	-1	-1	0	0	-1	-1	1	0	-1
	Environmental justice	-1	-1	-1	-1	-1	-1	-1	-1	-1
	Crime	-1	0	-1	-1	0	-1	0	-1	-1
	Social capital	-1	-1	1	1	1	-1	-1	-1	1

Table 13: Content Analysis for LEED-ND Prerequisites and Credits in the Green Infrastructure and Buildings Category

		GIB Prerequisite 1	GIB Prerequisite 2	GIB Prerequisite 3	GIB Prerequisite 4	GIB Credit 1	GIB Credit 2	GIB Credit 3	GIB Credit 4	GIB Credit 5	GIB Credit 6	GIB Credit 7
ENVIRO. HEALTH	Action	1	1	1	1	1	1	1	1	1	1	1
	Mechanism	-1	1	1	1	-1	1	1	1	1	-1	1
	Goal	-1	1	1	1	-1	1	1	1	1	-1	1
Goal Topic	Species diversity	-1	0	0	0	-1	0	0	0	0	0	1
	Natural resources	-1	1	1	1	-1	1	1	1	1	-1	0
	Water pollution	-1	1	1	1	-1	1	1	-1	-1	-1	-1
	Air pollution	-1	1	0	1	-1	1	0	-1	-1	-1	-1
HUMAN HEALTH	Action	1	1	1	1	1	1	1	1	1	0	1
	Mechanism	-1	1	-1	1	-1	1	-1	-1	-1	0	-1
	Goal	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1
Goal Topic	Malnutrition	0	0	-1	-1	0	0	-1	-1	0	0	0
	Chronic disease	-1	-1	0	-1	-1	-1	0	0	-1	0	-1
	Infectious disease	0	0	0	0	0	0	0	0	0	0	0
	Mental health	-1	0	0	0	-1	0	0	0	0	0	-1
	Accidental injury	-1	0	0	0	-1	0	0	0	-1	0	0
SOCIAL HEALTH	Action	1	1	1	1	1	1	1	1	1	1	1
	Mechanism	-1	1	-1	-1	-1	1	-1	-1	-1	1	-1
	Goal	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1
Goal Topic	Economy	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
	Environmental justice	-1	-1	-1	-1	-1	-1	-1	0	-1	0	-1
	Crime	0	0	0	0	0	0	0	0	-1	0	-1
	Social capital	0	0	0	0	0	0	0	0	-1	1	-1

Table 14: Content Analysis for LEED-ND Prerequisites and Credits in the Green Infrastructure and Buildings Category Continued

		GIB Credit 8	GIB Credit 9	GIB Credit 10	GIB Credit 11	GIB Credit 12	GIB Credit 13	GIB Credit 14	GIB Credit 15	GIB Credit 16	GIB Credit 17
ENVIRO. HEALTH	Action	1	1	1	1	1	1	1	1	1	1
	Mechanism	1	1	1	1	1	1	1	1	-1	1
	Goal	1	1	1	1	-1	-1	1	1	-1	1
Goal Topic	Species diversity	0	1	0	0	0	0	0	0	0	1
	Natural resources	1	-1	1	1	-1	-1	1	1	-1	0
	Water pollution	1	-1	-1	-1	-1	-1	1	-1	-1	0
	Air pollution	0	-1	-1	-1	-1	-1	0	-1	-1	0
HUMAN HEALTH	Action	1	1	1	1	1	1	1	1	1	1
	Mechanism	-1	-1	-1	-1	-1	-1	-1	-1	-1	1
	Goal	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Goal Topic	Malnutrition	-1	0	0	0	0	0	-1	0	0	0
	Chronic disease	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
	Infectious disease	-1	-1	0	0	0	0	-1	0	0	0
	Mental health	0	-1	0	0	0	0	0	0	0	-1
	Accidental injury	0	-1	-1	-1	-1	-1	0	-1	-1	-1
SOCIAL HEALTH	Action	1	1	1	1	1	1	1	1	1	0
	Mechanism	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
	Goal	-1	-1	-1	1	-1	-1	-1	-1	-1	0
Goal Topic	Economy	-1	-1	-1	1	-1	-1	-1	-1	-1	0
	Environmental justice	-1	-1	-1	-1	-1	-1	-1	-1	-1	0
	Crime	0	0	0	0	0	0	0	0	0	0
	Social capital	0	0	0	0	0	0	0	0	0	0

Table 15: Content Analysis for HDMT Objectives in the Environmental Stewardship; Sustainable and Safe Transportation; and Social Cohesion Categories

		Objective ES.1	Objective ES.2	Objective ES.3	Objective ES.4	Objective ES.5	Objective ST.1	Objective ST.2	Objective ST.3	Objective SC.1	Objective SC.2	Objective SC.3
ENVIRO. HEALTH	Action	1	1	1	1	1	1	1	1	1	1	1
	Mechanism	1	1	1	1	1	1	1	-1	1	-1	-1
	Goal	1	1	1	1	-1	1	1	-1	-1	-1	-1
Goal Topic	Species diversity	1	1	0	0	-1	0	0	0	0	-1	-1
	Natural resources	1	1	-1	-1	0	1	-1	-1	0	-1	-1
	Water pollution	1	1	1	0	0	-1	1	-1	-1	-1	-1
	Air pollution	1	1	1	1	0	1	1	-1	-1	-1	-1
HUMAN HEALTH	Action	1	1	1	1	1	1	1	1	1	1	1
	Mechanism	1	1	1	1	1	1	1	1	1	-1	-1
	Goal	1	1	1	1	1	1	1	1	1	1	-1
Goal Topic	Malnutrition	1	0	0	0	0	0	0	0	0	-1	-1
	Chronic disease	1	1	-1	1	1	1	1	1	-1	1	-1
	Infectious disease	1	0	-1	0	0	1	-1	-1	0	-1	-1
	Mental health	1	1	0	1	1	1	-1	1	1	-1	-1
	Accidental injury	0	0	1	1	0	1	-1	1	1	-1	1
SOCIAL HEALTH	Action	1	1	1	1	1	1	1	1	1	1	1
	Mechanism	1	-1	1	1	1	1	-1	1	1	1	1
	Goal	1	1	1	-1	1	1	-1	1	1	1	1
Goal Topic	Economy	1	0	1	0	0	0	0	0	1	-1	1
	Environmental justice	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	1
	Crime	0	1	-1	0	0	1	-1	-1	1	-1	1
	Social capital	0	1	1	0	1	1	-1	1	1	1	1

Table 16: Content Analysis for HDMT Objectives in the Public Infrastructure/Access to Goods and Services; Adequate and Healthy Housing; and Healthy Economy Categories

		Objective PI.1	Objective PI.2	Objective PI.3	Objective PI.4	Objective PI.5	Objective PI.6	Objective PI.7	Objective PI.8	Objective HH.1	Objective HH.2	Objective HH.3	Objective HH.4	Objective HE.1	Objective HE.2	Objective HE.3	Objective HE.4
ENVIRO. HEALTH	Action	0	1	0	1	1	1	1	1	0	0	0	1	1	0	0	1
	Mechanism	0	1	0	-1	-1	1	1	1	0	0	0	-1	1	0	0	1
	Goal	0	1	0	-1	-1	1	-1	1	0	0	0	-1	-1	0	0	-1
Goal Topic	Species diversity	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Natural resources	0	-1	0	-1	0	1	-1	-1	0	0	0	-1	-1	0	0	-1
	Water pollution	0	-1	0	-1	-1	-1	-1	1	0	0	0	0	-1	0	0	-1
	Air pollution	0	1	0	-1	-1	-1	-1	1	0	0	0	-1	-1	0	0	-1
HUMAN HEALTH	Action	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Mechanism	-1	1	-1	1	1	1	1	1	1	-1	-1	-1	-1	1	-1	1
	Goal	1	1	1	1	1	1	-1	1	1	1	1	1	1	1	1	-1
Goal Topic	Malnutrition	0	1	0	-1	0	0	-1	1	1	0	1	0	1	-1	-1	0
	Chronic disease	0	1	0	1	1	1	-1	1	1	1	1	1	1	1	1	-1
	Infectious disease	0	0	0	-1	0	0	0	0	1	0	1	0	1	1	-1	0
	Mental health	-1	-1	1	-1	1	0	0	0	1	1	0	0	1	1	1	0
	Accidental injury	1	1	0	-1	0	0	0	0	1	1	1	1	1	1	1	0
SOCIAL HEALTH	Action	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Mechanism	-1	-1	-1	-1	-1	1	1	1	1	-1	1	1	-1	1	-1	-1
	Goal	1	1	-1	-1	1	1	1	1	1	1	1	-1	-1	-1	1	1
Goal Topic	Economy	1	1	0	-1	0	1	-1	-1	0	0	0	-1	-1	-1	-1	1
	Environmental justice	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
	Crime	1	1	-1	0	-1	1	1	1	1	1	1	0	-1	-1	1	0
	Social capital	1	1	-1	0	1	-1	-1	1	1	1	1	-1	-1	-1	-1	0

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